



SATURDAY, MARCH 14, 1874.

Todd's Patent Car Coupler.

The horrible loss of life and limb from coupling cars has not failed to attract the attention of inventors, and has been to them an inviting field for the exercise of their ingenuity. We regret, however, to say that usually they have shown more ingenuity than knowledge in their inventions, and at the present time, although hundreds of patents for coupling cars have been issued, there is only one, the Miller coupling, which is much used. We illustrate herewith another device intended for this purpose. Fig. 1 is a longitudinal section, fig. 2 a side view, fig. 3 a horizontal section, and fig. 4 a plan of a car "draw head." A, fig. 1, is a sort of latch which works on the pin b, and is raised up by the link c. As soon as the link has passed under the latch or hook, it drops down, and thus couples the cars together. They can easily be uncoupled, by raising the hook which has a small eye on top, to which a chain is attached for that purpose. The latch A is made of wrought iron, and the draw-head of cast iron. The construction of this device in other respects is very obvious from the engraving, so that no further description is required, and nothing need be said to commend such an invention if its practicability can be demonstrated. The inconceivable horror which attends the existing method of coupling cars would be enough to command any practicable invention which will lessen or prevent the present mutilation and slayhter of those

are not sheltered. In a climate where the thermometer ranges from 10 to 30° below freezing, fuel consumed to keep the engines alive (which has been found to average about one ton of coal, or from one and a half to two cords of wood, every twenty-four hours), together with the necessary labor to take care of them, enters largely into their expense account, which appears against them without a corresponding representation of mileage; and to compare the performance of a road laboring under such disadvantages with an old established line would be entirely unfair.

As stated in your issue of November 22, the subject involves many knotty points, and the more one studies the question the more he becomes aware of this fact. In order to get at such a comparative statement as seems to be desirable, the ratio of resistance due to friction and gravity, on the various grades and curves, must be computed and reduced to an average. Resistance due to wind and velocity of trains, average mean temperature of the various climates, condition of rail, size and weight of engines, cost of removing snow and ice, relative expenses due to accident, incrustation of boilers, etc., variations in wages of employees, difference in the value of various kinds of fuel, engine house and shop accommodations, shop tools and machinery, and other facilities for repairs, all have to be considered, according to the qualifications of each road respectively. Nothing short of an essay upon each of the above points would present a lucid and interesting abstract of the whole in all its bearings, and in order to figure it all out (if indeed it can be done at all) in shape to appear on a locomotive statement, an additional clerical force would be required, and, as stated by your Sacramento correspondent, it is doubtful whether the end will justify the means.

A question may here arise as to the practical value then of a locomotive statement if it cannot be compared with the like

monthly statement, the difference in the performance of this engine from that of any other would not be noticed. The value of performance-sheets as a means of economy may be further illustrated by an instance which came under the writer's observation in 1872. On a certain well-known road, one class of engines of exactly the same pattern were found to average from eight to ten miles less to the ton of coal than another class of about the same weight and capacity. All were engaged in similar freight service, and running alternately (first in, first out); hence the comparison must have been nearly correct. After watching these engines for a considerable length of time, the Master Mechanic ordered an alteration in their valve motion, which resulted in a gain of from eight to ten miles to the ton of coal, or a saving of from forty to sixty dollars per month to each engine, and the engineers claimed that the engines hauled more cars and did their work easier than ever before.

Other instances of this kind might be referred to, all of which are due to the accuracy and regular issue of the performance-sheet.

The present form of statement on many roads is very deficient, and should be at least so revised as to make an intelligent and accurate showing of the expense of each engine in detail, as well as the total expenses of the locomotive department. The practical value of a proper system for monthly statements will not be denied; the only question is, How shall they be arranged, to suit all cases and become a reliable sheet?

In order to determine this, the writer would suggest that the Superintendents' and Master Mechanics' associations appoint a committee who shall jointly prepare a plan, determine the list of expenses strictly belonging to locomotives, and the most efficient and simple method of conducting mechanical-

Fig. 3.

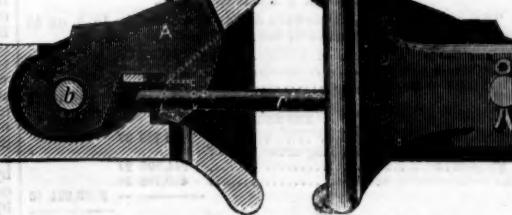
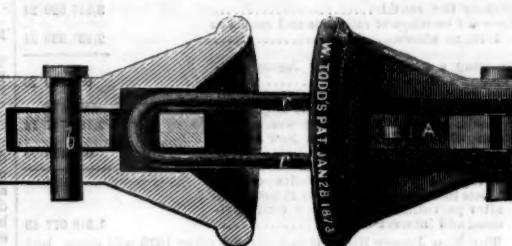


Fig. 1.

who are now obliged to expose themselves to imminent danger every time a train is made up or a car coupled. The invention we have illustrated has been put into practical operation, and is said to work well. The inventor is Mr. William Todd, of Boston, Mass. Messrs. Williams, Page & Co., the well-known dealers in railroad supplies in Boston, are managing the business for the patentee. The claims which are made for this invention are clearly stated in an advertisement on another page, to which and to the advertisers we refer those who wish further information regarding it.

Contributions.

Uniformity in Locomotive Reports.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It is quite evident this subject needs to be thoroughly discussed, and fully understood before a satisfactory solution can be arrived at. Yet it does not appear, after all, to be a very difficult matter to devise simply a uniform system of reports which would be equally applicable to all roads, so far as the matter of keeping and distributing accounts, computing mileage, etc., is concerned. The mileage of cars and tonnage hauled can also be approximated, if not accurately reached, and credited to each engine in its due proportion. The cost per mile for engine expenses, as well as the average cost of hauling one ton or one car one mile—also, if desired, the average cost per mile for car repairs—could appear in the statement. Such a report would make a very valuable and interesting record, from which accurate and important results might be obtained.

It is the opinion of the writer that except in the case of lines where all things are nearly equal, it would be very difficult to make a performance sheet that might be taken as a safe criterion to compare the management of one road with that of another. In a northern climate, where more or less snow is constantly falling during the entire Winter, it is not unfrequent that engines are engaged clearing track of snow and ice for many days, without even hauling a ton of freight. Trains on all new roads are more or less delayed at stations for want of fuel, water, side track and depot facilities. Shop and engine-house accommodations are also generally very limited, so that probably one-fourth of the whole number of engines in service

from other roads. Probably the original design of such a sheet was simply to compare the performance of one engine with that of another on the same road, and the wisdom and utility of the practice may be observed by the rivalry it produces among engineers to run economically. Their reputation generally depends upon the economical performance of their engines; and to determine this, as well as to maintain this discipline, the locomotive statement should be accurately prepared and regularly issued.

Another question may arise as to the necessity of adopting a uniform style of statement, if the comparison with other roads should be found impracticable. It certainly does not become a necessity; but if a uniform plan, together with the proper expenses and number of loaded cars, or tonnage hauled per mile, or both, can be adopted, an approximate comparison can be made on lines similarly equipped and located. The writer will not in this article attempt to define the numerous items chargeable to locomotive expenses; suffice it to say that a uniform system in this particular would not be difficult, providing all roads would adopt one general system of mechanical department accounts.

The practical value of the locomotive statement, as at present prepared, can be readily understood when we take into consideration the extremely few engineers that would ever have learned to run cheaply if they were not for the regular appearance of the locomotive statement, frequently followed by interrogations from the master mechanics relative to the cause of an engine falling below the average of locomotives in similar service. Such criticism would naturally lead the engineer in question to ferret out the discrepancy in the consumption of fuel, which may be traced to direct causes, such as blowing off the valves or pistons, leaky flues, fire-box or boiler. Quite likely the boiler and flues may be thickly coated with scale, and so clogged with mud that the engine cannot be made to steam freely. This may frequently be the case when the machinery is in good order; hence constant crowding of the fire by a free use of fresh fuel is continued from day to day, until finally the engineer, with just reason for complaint, reports something more seriously wrong with the engine than he can account for. Of course this engine should at once have such repairs as may be required to save this waste of fuel; but a press of business may render it impossible to dispense with the service of the machine, and it is allowed to run until a more convenient time presents itself. But for the

department accounts, and submit the same to each association for such action as the wisdom of the two bodies may approve.

Report of the Pennsylvania Railroad Company.

The following is an abstract of the twenty-seventh annual report presented at the stockholders' meeting in Philadelphia, March 10:

The Directors submit the following report of the operations of this company for the year ending on the 31st of December last:

The revenues of the company from its several investments, though curtailed to some extent by the effects of the late financial panic upon the business of the country during the last three and a half months of the year, have been very satisfactory, showing *surplus net profit* for the year, from your main line between Philadelphia and Pittsburgh, after meeting operating expenses, interest, taxes and two semi-annual dividends, at the rate of 10 per cent. per annum, of \$2,198,767.14, which amount is largely in excess of any deficiency that can occur in the operations of its leased lines and on account of its guarantee.

It is believed the net results for 1874 will show much more favorably, inasmuch as the extensive improvements which are being made to afford additional facilities for moving and handling the large increase of tonnage with economy and dispatch over your railways and at the terminal points at Pittsburgh, Philadelphia and Jersey City, will be essentially completed within a few months. A partial and satisfactory use of them was had during the closing months of 1873.

The net profits of the first month of this year upon the line between Jersey City and Pittsburgh exceed those of the corresponding month of last year \$486,300, without any material increase in its gross revenues—a result mainly due to the saving effected through these increased facilities and the reduction of the price of materials and operating expenses.

THE PENNSYLVANIA RAILROAD.

The revenues and expenses of your main line between Philadelphia and Pittsburgh during 1873, with its branches, were as follows:

From passengers.....	\$4,169,141 97
From emigrant passengers.....	230,029 49
From mail.....	158,287 50
From express matter.....	450,241 40
From general freights.....	19,608,555 07
From miscellaneous sources.....	269,233 47
	\$24,886,008 90
For conducting transportation.....	\$5,064,140 57
For motive power.....	4,223,530 53
For maintenance of cars.....	1,926,995 53
For maintenance of road.....	3,246,832 20
For general expenses.....	379,706 38
	\$15,440,305 16

Leaving net earnings in 1873..... \$9,445,701 74

In the above cost of "maintenance of road" is included the difference in the price paid for steel rails to replace those of iron, amounting to 16,760 tons, or about \$670,000.

The net earnings Pennsylvania Railroad for 1873, as above stated, were..... \$9,445,703 74
The net earnings Pennsylvania Railroad for 1872 were..... \$8,247,851 18

Showing increase in 1873 of..... \$1,197,851 56
The total earnings of these works in 1873 were..... 24,880,000 90
And for 1872..... 22,013,525 27

Showing the increase in 1873 of gross earnings..... \$2,873,483 63
Of the above earnings there were received from the 358 miles of main line:

In 1873 (\$62,314.19 per mile)..... \$22,908,481 68
In 1872 (\$55,996.14 per mile)..... 20,010,818 80

Increase from the main line..... \$2,897,662 88

And from the branch lines leased and owned, excepting the Philadelphia & Erie Railroad:

In 1873—511 miles in length..... \$2,577,527 22
In 1872—426 miles in length..... 2,001,706 47

Increase from branch lines:

The earnings of branch lines operated by your company in 1873, as already stated, were..... 2,577,527 22
The expenses of operating them, including rents of the leased branches, were..... 2,560,097 10

Showing a net direct profit in operating these lines of..... \$17,430 12

The sources of revenue in 1873, compared with those of 1872, show the following figures:

	Decrease.	Increase.
From first-class passengers	\$ 9,476 59	\$ 147,129 17
From emigrant passengers		
From general freights	2,751,663 66	3,372 72
From mails	3,372 72	614 06
From express matter	19,820 38	
From miscellaneous		

Total net increase, as above stated..... \$2,873,483 63

The whole number of passengers carried in 1872 was 5,250,396, and in 1873 5,879,684, an increase of 629,291, or 11.98 per cent. The average distance travelled by each passenger was 30.18 miles, being 2.93 less than in 1872.

The number of tons of freight moved (including 787,560 tons of fuel and other materials for the company's use) was 9,908,794 tons, embracing 4,527,501 tons of coal. It was last year 8,459,535 tons, showing an increase of 1,559,259 tons, or over 18.19 per cent. The increase in coal tonnage over that of 1872 was 858,430 tons.

The actual cost of operating your railroad in 1873 was, including branch lines, 62.04 per cent. of receipts.

Excluding branch lines, 57.74 per cent. of receipts.

The disposition of the net earnings is shown as follows:

Dividends.....	\$5,918,140 00
Interest on bonds.....	2,789,178 45
Less income from investments.....	2,372,107 64
Rental of Harrisburg and Lancaster road.....	132,651 46
State taxes.....	369,074 33
Paid State on account of interest and principal of purchase of public works.....	460,000 00

Which subtracted from net earnings leaves..... \$7,246,956 60

THE NEW JERSEY LINES.

The earnings of the United Railroads of New Jersey and branches, and the Philadelphia and Trenton Railroad, in all 273 miles of road, were in 1873:

From passengers.....	\$4,660,122 37
From freights.....	3,932,281 39
From express matter.....	271,665 20
From mails.....	49,511 07
From miscellaneous sources.....	137,009 90

EXPENSES.

For conducting transportation.....	\$3,283,910 99
For motive power.....	1,637,376 75
For maintenance of cars.....	434,990 38
For maintenance of road.....	1,337,470 12
For general expenses.....	98,539 87

Leaving net earnings in 1873..... \$6,792,188 05

The sources of revenue in 1873, compared with those of 1872, show the following increases and decreases:

Increase.	Decrease.
Passengers.....	\$86,809 85
Freights.....	134,987 53
Express matter.....	35,310 25
Mails.....	1,026 07
Miscellaneous.....	\$7,570 57

Total net increase..... \$250,513 13

The whole number of passengers carried in 1873 was 8,003,043, and in 1872, 7,580,795, an increase of 422,248, or nearly 5.6-10 per cent.

The average distance travelled by each passenger was 20.9-10 miles, being 4-10 of a mile less than in 1872.

The number of tons of freight moved (including 197,365 tons of fuel and other material for the company's use) was 3,051,577 tons, embracing 415,940 tons of coal; it was last year 2,536,304 tons, showing an increase of 515,273 tons, or over 20.31-100 per cent.

The actual cost of operating the United Railroads of New Jersey, including branches, after deducting transit duties, rent of Connecting Railroad and interest on property, and excluding Belvidere Division, in 1873 was 74.4-10 per cent. of its receipts. The cost of moving freight on these railroads in 1873 was within 3-10 of a mill per ton per mile of the whole amount received for the service, chiefly in consequence of the great expense of handling it and the cost of ferries.

On these lines, as well as on nearly all of the other lines worked by this company, it appears that more passenger trains were run during 1873, for the accommodation of the public, than were justified by their receipts, and, therefore, these facilities have been to some extent reduced.

The additional tracks laid upon the line of the railway, to avoid detention in the movement of trains, and the increased terminal facilities, provided to lessen the cost of handling freights, will, it is hoped, enable the New Jersey lines to meet their rental in future out of their own earnings.

The earnings of the Belvidere Delaware Railroad, 68 miles, and the Flemington Branch, 12 miles, were in 1873:

From passengers.....	\$105,220 62
From mails.....	5,768 98
From express matter.....	3,974 07
From general freights.....	938,326 30
From miscellaneous sources.....	6,040 79

EXPENSES.

For conducting transportation.....	\$248,956 40
For motive power.....	210,260 27
For maintenance of cars.....	79,686 60
For maintenance of road.....	292,980 38

Showing a balance to credit of Belvidere Delaware Railroad, and Flemington Branch, for 1873, of..... \$322,310 11

The following statement gives the increase in business of the Belvidere Delaware line for 1873, over 1872, including the first three months of 1872, during which time the road was operated by the Belvidere Railroad Company:

First three months, 1873.....	\$187,287 86
Last nine months, 1873.....	664,993 18
Total for 1873.....	\$851,681 04

Total net increase..... \$296,541 72

The whole number of passengers carried in 1873 was 297,153, and the average distance travelled by each passenger was seventeen miles.

The number of tons of freight moved (including 26,758 tons of fuel and other materials for the company's use), was 1,445,573 tons, embracing 1,224,528 tons of coal.

The actual cost of operating the Belvidere Delaware Railroad, including the Flemington Branch, in 1873, was 71.98-100 per cent. of its receipts.

No comparisons of tonnage and passengers are made with 1872, as the Pennsylvania Railroad Company did not assume the management of the Belvidere Delaware Railroad until April 1, 1872.

The earnings of the Philadelphia & Trenton Railroad and branches, 38 miles, and the United Railroads of New Jersey and branches, 238 miles, Belvidere Delaware Railroad, 68 miles, and Flemington Branch, 12 miles, and the Delaware & Raritan Canal, 61 miles, including feeder, in 1873, were:

From United Railroads of New Jersey.....	\$8,516,739 93
From Belvidere Delaware Railroad and Flemington Branch.....	1,148,222 76
Delaware and Raritan Canal.....	1,590,100 12

\$9,664,962 69

Total earnings during 1873..... \$11,255,002 81

EXPENSES.

Of the United Railroads of New Jersey.....	\$16,792,186 05
Of the Belvidere Delaware Railroad and Flemington Branch, including net earnings (\$322,310 11).....	1,148,222 76
Of the Delaware & Raritan Canal.....	833,321 46

\$8,833,732 27

Total net earnings of railroads and canals in 1873..... \$2,431,380 54

Interest on bonds of United Railway Company..... 1,168,570 24
Dividends to shareholders..... 1,948,450 00

Making the rental..... 8,117,020 24

Less net earnings of railroads and canals in 1873, as above..... 2,431,380 54

Showing a loss on the New Jersey Railroads and canals of..... 685,689 70

The net profit of the Pennsylvania Railroad, after paying interest and dividends, &c., as before stated was.....

From which deduct loss on New Jersey Railroads..... 2,198,767 14

685,689 70

Leaving as surplus net profits on the whole line from New York to Pittsburgh, after providing for a 10-per cent. dividend and interest to 60.

DELAWARE & RARITAN CANAL.

The earnings of the Delaware & Raritan Canal in 1873, on 44 miles of canal and 17 miles of feeder, from tolls were:

From tolls.....	\$1,047,360 43
From steam towing.....	518,097 38
From miscellaneous.....	23,762 31

\$1,600,100 12

EXPENSES.

For maintenance of canal.....	\$188,199 37
For canal operation, including drawbacks of \$70,108.75.....	244,393 29
For steam-towing account.....	450,788 50

\$883,321 46

Leaving net earnings in 1873 of..... \$706,778 66

Being an increase in net earnings over 1872 of..... \$198,210 91

The number of tons of freight moved was 2,754,887 638-2240, embracing 1,977,105 tons of coal. It was last year 2,887,532 194-2240 tons, showing a decrease of 82,695 1266-2240 tons, or 29-10 per cent.*

Notwithstanding the increased cost of towage by reason of the obstruction of the bridge across the Raritan, the average cost of moving freight was 677-1000 cents per ton per mile, and for 1872 739-1000 cents per ton per mile, showing a decrease of 62-1000 cents per ton per mile. The actual cost of operating your canal was 55.55-100 per cent. of its receipts.

The canal is capable of accommodating a much larger tonnage than now passes through it without further outlays for construction, and this traffic must continue to grow with the population and wealth of the whole seaboard, if not interfered with by the obstructions referred to.

Its business has been well systematized by its General Superintendent, I. J. Wistar, and is now conducted with much economy and promptness.

PHILADELPHIA & ERIE.

The earnings of the Philadelphia & Erie Railroad in 1873 were:

From passengers.....	\$632,620 30
From freights.....	3,043,866 00
From express matter.....	41,189 10
From mails.....	30,748 41
From miscellaneous sources.....	94,708 39

Total (nearly \$18,340 61 per mile of road)..... \$3,842,067 20

The operating expenses during the same period were:

For conducting transportation.....	\$872,256 99
For motive power.....	902,781 49
For maintenance of cars.....	898,390 03
For maintenance of road.....	1,179,862 33

\$3,418,310 84

Showing balance to the credit of P. & E. R. R. Co. of..... \$428,756 36

The sources of revenue in 1873, compared with those of 1872, show the following increases and decreases:

Increase.	Decrease.
Passengers.....	\$ 14,653 79
Freights.....	134,743 92
Express matter.....	8,728 77
Mails.....	8,175 21
Miscellaneous.....	11,264 60

Total net decrease..... \$138,685 67

The whole number of passengers carried in 1872 was 839,793, and in 1873, 777,273, a decrease of 62,520, or nearly 8 per cent.

The average distance travelled by each passenger was 26 miles, being 1.50-100 miles more than in 1872.

The number of tons of freight moved (including 191,988 tons of fuel and other materials for the company's use) was 2,856,

* The tonnage delivered by this canal into the Raritan River exceeds that delivered by the Erie Canal into the Hudson River, and equals that of the foreign trade of New York, both in American and foreign vessels passing out at Sandy Hook.

234, embracing 259,259 tons of coal. It was last year 2,211,209 tons, including fuel and other material for company's use, showing an increase of 144,985 tons, or over 6.5-10 per cent.

The actual cost of working the Philadelphia & Erie Railroad in 1873 was 84.84-100 per cent. of its receipts; but for the panic of September last the results of the operation of this line would have been about the same as last year. The country at present drained by the Philadelphia & Erie Railroad has a very limited local traffic, except in lumber, and the demand for this seemed to cease with the commencement of the late financial panic; and as the country traversed is poor, the consumption of merchandise fell off to the lowest point, and has not since revived. Another cause for the falling off in the gross receipts is the decrease in the oil trade, consequent upon the change that has occurred in the oil-producing territories of the region near Titusville and Titusville, which have ceased to yield their former production; and to the discoveries of the new oil territories near Brady's Bend, on the Allegheny River, and in Butler County, from which the largest shipments are now obtained. The centres of production are about one hundred miles distant from the line of the Philadelphia & Erie road, and the greater part of the oil produced there is thus thrown upon the Western Pennsylvania Railroad, connecting with the main line of your railroad at Blairsville. The opening of the "Low-grade road" in May next will restore a share of this traffic to the Philadelphia & Erie road, at the Bennett's Branch Junction, giving it about 120 miles of transportation.

AVERAGE RECEIPT PER TON AND PER PASSENGER PER MILE.

The following table shows the average earnings from freight and passenger traffic, and the cost of moving it per net ton and per passenger per mile on each of the railways worked by the Pennsylvania Railroad Company:

NAMES OF RAILROADS.	MILES OF RAILROAD WORKED.	AVERAGE RECEIPT PER TON OF FREIGHT, IN MILLIONS OF DOLLARS.	AVERAGE EXPENSES FOR FREIGHT, IN MILLIONS OF DOLLARS.	AVERAGE RECEIPT PER PASSENGER, IN MILLIONS OF DOLLARS.	AVERAGE EXPENSES FOR PASSENGERS, IN MILLIONS OF DOLLARS.	PERCENTAGE OF INCREASE OR DECREASE.
PER MILE.	PER MILE.	PER MILE.	PER MILE.			

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alluded to, was made upon the same principle adopted by every merchant, if at the end of each year the stock of merchandise he may have on hand had materially advanced in value, as was the case with the real estate of that company, and the addition to its works paid for out of the net profits of the railway.

The Pennsylvania Railroad Company, as already shown, has pursued a different policy, giving to its shareholders liberal dividends from the date of the commencement of the surveys for the enterprise, passing only one semi-annual dividend of 3 per cent, during the prevalence of the financial panic of 1857, until the present time.

The Baltimore & Ohio Railroad Company, from the necessity of applying their whole net revenues to the construction of their railway, pursued for many years a still more conservative policy, having paid the shareholders of its main line dividends averaging only 3-10 of one per cent. per annum, or in the aggregate only amounting to six per cent. for the first twenty years of its existence—an amount just equal to the payments by this company in dividends during the first year of its organization.

For the following six years the Baltimore & Ohio Railroad Company paid to the shareholders of its main line dividends averaging 3% of one per cent. per annum, amounting in the aggregate to but 4% per cent. for the entire period of six years, while the shareholders of the Pennsylvania Railroad Company received for the same period 36 per cent. from the profits of the line, and on the completion of the railroad to Pittsburgh with a single track there was left from the net profits of the railroad \$287,431.41, which amount, under the provisions of its charter, was credited to the cost of construction, thus reducing to that extent the capital of the company. From 1858, when your line was opened to Pittsburgh, up to 1873—twenty years—the dividends of the Pennsylvania Railroad Company have averaged 9-10 per cent. per annum, the total dividends of the company from its organization to the 1st of January of this year having been 284 per cent.

From these statements it will be perceived that the complaint of "watering" railroad stocks does not apply to the Pennsylvania Railroad Company. The unsatisfactory financial condition of a number of railroad companies is mainly due to their construction in advance of the requirements of the country, many of them having been built as rivals to other lines where the traffic was scarcely sufficient for one.

INVESTMENTS.

The surplus income of this company has gradually accumulated to an amount which, after charging the whole of expenditures made by it in connection with the Southern Security Company, and other investments of doubtful value, to profit and loss, as we did after the panic of 1857, with a similar investment, made in the Cincinnati & Marietta Railway, there is still standing to the credit of income account the large sum of \$8,842,563.49, all of which is represented by the disbursements on your railroad and its connections.

Since the civil war the investments made by Northern capitalists in railroads of the Atlantic slope of the Southern States, have generally proved disastrous, chiefly from the financial exhaustion of this region and its slow recuperation. The gradual accumulation of new capital among themselves promises hereafter a period of greater prosperity.

Though the whole of the expenditures by this company in connection with the Southern Security Company has been charged to profit and loss, and carried to the suspense account, it is believed that they will in time yield some favorable returns, and bring traffic of some value to the lines controlled by this company, for the benefit of which this expenditure was originally undertaken.

The last annual report of your directors gave for the first time a statement that exhibited the full net profits of the company, nothing having been charged to expenses that was properly due to construction account, except probably the difference between the cost of steel and iron rails. This was done, as then stated, for the purpose of enabling the shareholder to determine for himself the value of his share. The net profits of the company were therein shown to have been over fifteen per cent.

The surplus, after paying 10 per cent. per annum dividends, amounting to \$2,995,423, was credited to profit and loss. Notwithstanding this explicit statement of our net revenues for 1872, and the assurance from time to time that the business of the company in 1873 was satisfactory in its results, your shares at the close of the year became needlessly depressed in price. Its depression below the price of the shares of other leading railroad companies of this State does not seem to be justified by the present condition and future prospects of this company.

The obligations of this company for rentals and guarantees of leases on account of the lines now operated by the Pennsylvania Company west of Pittsburgh, as will be seen by the statement appended to the Treasurer's report, have all been met from the net revenues of the lines, except within the sum of \$399,244.98, and this has been provided by the Pennsylvania Company out of its other resources, and is, consequently, not a charge upon the revenues of this company.

These lines control and deliver to and distribute from our main line a large amount of through traffic, which, though the margin of profit on it per ton and per passenger is small, adds materially to the net profits of this company. These profits have also enabled the Pennsylvania Railroad Company to reduce the charges for transportation of local traffic within the State of Pennsylvania to their present low standard.

The lines east of Pittsburgh for which interest and rentals have been guaranteed by this company, except the New Jersey lines (deducted elsewhere from the receipts of the main line), have all met and paid their own liabilities, except those set forth in the tabular statement attached to the treasurer's report, amounting in the aggregate to \$1,163,749.87, from which deduct the surplus accruing to the credit of the Western Pennsylvania Railroad Company, \$240,968.77, leaving a balance of \$923,781.10, which sum has been advanced by this company. The respective companies are charged with the amounts advanced for them, to be repaid out of their earnings and other resources. The shareholders will understand that in each of these cases where advances have been made the companies are controlled by this company, under leases or otherwise.

Accompanying the Treasurer's report will be found a detailed list of the bonds and stocks owned by this company, many of which were purchased during the past twenty years, and are now held to control the respective lines, aggregating at their par value \$73,594,440, which cost this company \$52,692,419.09, on which cost they are now paying into the treasury of this company over 4 per cent. per annum. Some of these securities are not now paying interest or dividends, but it is believed, as the lines are developed, they will become sufficiently profitable to make all these investments pay an average of over 6 per cent. per annum on their cost.

This company, in addition thereto, will always enjoy the control of the traffic of these lines, which each year, under prudent management, must become more valuable.

The Master Mechanics' Association Circulars of Inquiry.

The following additional circulars have been issued by Committees of this Association:

BALANCE SLIDE-VALVES.

The Committee appointed at the last annual meeting of the American Railway Master Mechanics' Association, on the subject of Balance Slide-Valves, beg leave to request your an-

swers to the following question and any other information you may have on the subject.

1st. Have you had any experience with balance slide-valves? If so, please state fully what advantages they possess over the ordinary valve.

2d. Have you had any experience in changing the size of the ports upon the same cylinder, in order to determine in practice what are the proper proportions of the size of ports to the size of cylinders. If so, state the result?

3d. What in your experience has proved to give the best results as to the amount of inside and outside lap?

4th Please give the length of time and the number of miles run, and the condition of the valve-seat on the cylinder with the ordinary valve and also the same with the balance-valve?

5th. In your opinion, would it be advantageous to shorten the ports and widen the bridges so as to increase the wearing surface on the valve seat of the cylinder?

6th. Please send a correct drawing of the balance valve you have tried, and the name of the patentee?

Respectfully yours,

J. I. KINSEY,
Master Mechanic, Lehigh Valley Railroad.

J. THOMPSON,
Master Mechanic, Eastern Railroad.

G. H. TIER,
Master Mechanic, Lake Shore & Mich. Southern Railway.

Please address replies to

J. I. KINSEY, South Easton, Pa.

LUBRICANTS FOR LOCOMOTIVES.

The undersigned Committee appointed by the American Railway Master Mechanics' Association to report on the best "Lubricant for Cylinders and other Machinery of Locomotives," respectfully solicit answers to the following questions, and such additional information as in your judgment will be of advantage to the Committee in compiling a report:

1st. What is the best lubricant in use for valve-seats and cylinders of locomotives? Please state your preference, and your reasons therefor?

2d. Have you ever used any mineral oils, or mixture of plum-bago, that you can recommend as superior to tallow or Extra No. 1 lard oil?

3d. In your opinion does the use of hard or soft water materially affect the value of tallow or oil as a lubricant, and if so, how?

4th. What kind of oil do you prefer for general use on locomotive bearings? If a mixture, how is it prepared, what are the ingredients and what is the average number of miles run per pint or quart?

5th. What method do you regard the best for oiling valves, the self-feeder or the old plan of oiling with a can at regular intervals?

6th. The Committee will be glad of any other information you may impart on the subject of oils for rolling stock, and especially journal bearings of cars.

Respectfully,

JACOB JOHANN,
Chicago & Canada Southern Railway.

W. B. SMITH,
South Carolina Railroad.

Committee.

Please send replies as early as possible to

J. H. SETCHEL, Secretary, Cincinnati.

A Mechanical Laboratory.

The following letter from Professor Thurston to the trustees of the Stevens Institute of Technology, and their reply thereto, need no explanation, except the statement that one or two other associations have entertained the idea of establishing a laboratory devoted to experimental research. The subject is more fully discussed on our editorial page:

DEPARTMENT OF MECHANICAL ENGINEERING,
STEVENS INSTITUTE OF TECHNOLOGY,
HOBKOKEN, N. J., Jan. 30, 1874.

To the Trustees of the Institute:

I have recently been called upon by gentlemen who are identified with important railroad interests, and who desired to discuss the advisability and the feasibility of a plan, already well matured, for the establishment of a department to be devoted especially to experimental investigations having a direct and practical bearing upon questions arising in the course of regular business.

A Laboratory for Technical Research, or a "Testing Laboratory" as it was denominated, it was stated, if properly organized, well equipped and effectively operated, could be made of exceptional value in the direct advancement of science, as well as in the promotion of purely practical interests.

The officers of our important lines of railroad, it was said, desired frequently to obtain dynamometric determinations of the resistance of trains and of the efficiency of locomotives; to learn with precision the strength and the various other hardly less important characteristics of materials which it was proposed to use in construction, and to ascertain the value of fuels and of lubricating materials.

Iron and steel makers are equally desirous of obtaining reliable and thoroughly accurate knowledge of the chemical constitution of their products and of their physical structure and properties, and such knowledge of the relations existing between these two sets of qualities as can only be secured by careful comparison of the result of skilful and systematic investigation.

The manufacturers of machinery and constructors generally are seriously in need of a recognized authority to which they may send the materials purchased by them, with confidence that their qualities shall be carefully determined and their value ascertained, and that the deductions from experimental examination shall be intelligently made, uninfluenced by any private interest.

Those members of the engineering profession who are engaged in general practice were said to constitute still another class of business men to whom such an institution would lend valuable aid, and, in fact, every business would derive directly or indirectly great advantage from its establishment.

Were the foundation of this proposed Laboratory to be shown to be practicable, it was thought that all would assist, and that the three classes just named would consider themselves justified in uniting to contribute to its creation and support; that business interest and a liberal policy would combine to secure its establishment on such a basis as would insure every facility for the investigation of problems arising daily in practical work in the systematic and thoroughly scientific and effective manner proposed.

It was considered that this laboratory, devoted to technical research and for the practical application of science in matters of business, should be under the charge of some scientific institution of acknowledged high character, in order that the perfect reliability of its work should be secured. It should be conveniently located in order that all of those who should aid in its establishment should find it readily accessible.

It should be supplied with the most delicate instruments, the most powerful testing machines of all kinds, and a full supply of the best forms of dynamometric apparatus to engineers.

It should have conveniently near a corps of scientific men familiar with the practice of engineering, whose opinion could at any time be asked in matters with which they might be most familiar.

The best collections of physical and chemical apparatus should be within reach of its officers, in order that they might, in the hands of those directly responsible for them, be brought into use whenever work in progress should render special researches in pure science advisable.

The laboratory should be provided with well trained and educated experimenters, capable of making satisfactorily any series of investigations that might be called for.

It was urged that these requisites could probably be best secured by the establishment of the proposed Mechanical Laboratory in connection with this Institute.

Its central location, its special adaption in plan and methods of instruction as a school of Mechanical Engineering, its extensive collections and their exceptional character, the completeness of its organizations and its thorough adaptation in all respects to this kind of work seemed to indicate this as the best possible location for such a new department as that proposed.

It was thought that should the trustees consider it advisable to accept such an addition to their responsibilities, and to grant the space needed, and also to guarantee a hearty co-operation, there would be no difficulty in securing from business men to be benefited by it a sufficient amount of capital to purchase a complete outfit and probably to provide such an endowment as should insure its support, without in any way taxing the resources of the college.

Should the plan succeed, it was thought that a moderate income might also be obtained by assessing the actual cost of special examinations upon those for whom they might be made, which should provide for a continual increase of facilities by additions to its stock of apparatus and by the improvement of its personnel.

This matter has appeared to me an extremely important one, and I have therefore no hesitation in placing it before you and asking its careful consideration.

I have consented without hesitation, in the event of your favorable action, to aid as far as lies in my power in the organization and operation of such a laboratory, and have promised, should it become necessary, to assume the responsibility of its direction, and to endeavor to secure such an administration as should compensate its founders for their expenditure of capital, and the Institute for the tax which its support may incidentally bring upon it, and such as should lend to the business interests of the country more efficient aid than they have been accustomed to receive from purely scientific work.

I believe that such a plan as that here laid before us would give to this country an institution such as has never yet been organized, and one whose value will prove beyond estimation. The accumulation of facts, the valuable application of science and the directly practical bearing of the work which may be done would, in a comparatively short time, be productive of richer results than have been attained in constructive science during many years past.

It would do most effectively that work which has hitherto been too much neglected, the application of scientific knowledge to familiar work and matters of business. It would do much to close up the space which so separated the man of business from the man of science, and would lead to a far more perfect system of mutual aid than has yet existed.

An institution like this can do no nobler work than that which, by assisting the improvement of technical methods and by the application of science to improvements in practical construction, aids in the development of the natural resources of our country, stimulates the growth, in extent and perfection, of its most important industries, and contributes in a thousand ways to the welfare of the people.

Very respectfully, E. H. THURSTON,
Professor of Mechanical Engineering.

REPLY OF THE TRUSTEES.

FEBRUARY 2, 1874.

Prof. R. H. Thurston:

SIR: The Trustees have to acknowledge the receipt of your favor of Jan. 30, and have given it careful consideration.

They are so favorably impressed with the proposed establishment, in connection with the Stevens Institute of Technology, of an adjunct "Laboratory for Technical Research," or "Testing Laboratory," as you denominate it, that they gladly give the plan their cordial approval and will render every assistance possible in its formation and maintenance.

Under proper restrictions they will be pleased to assume the responsibility of its government and safe-keeping.

The Trustees will accord all necessary space when not required by the Institute, whether within the present buildings or upon the grounds. They would grant the use of all facilities for investigation possessed by the Institute, only stipulating that the work of the College itself have precedence unless directed by them.

They would assist in organization and would gladly permit the faculty of the College to aid, as far as they may have the will and the power, and would also accept such responsibility as may in propriety and of necessity fall upon them.

They would consider the adjunct department as, in all but its maintenance, a part of the Institute, and as such entitled to their protection and claiming their hearty support.

Whatever they could properly do, without in any way sacrificing the interests of the Institute, they would do with pleasure.

It should not be forgotten that the Stevens Institute of Technology was established as a special school of mechanical engineering, and as such has a well-understood policy and well-defined aim.

To the accomplishment of this work all of these facilities supplied by its founder must be studiously directed, and the Trustees do not therefore feel themselves at liberty to direct any portion of its income to the maintenance of even an institution so valuable, as an adjunct to the college, as well as so important in its relations to industrial progress, as that proposed, and cannot therefore promise to afford direct pecuniary aid.

Such facilities as are possessed by the Institute would be freely placed at the service of the managers of the proposed laboratory.

As business men we recognize fully the importance of bringing into close relations as possible the science and industrial knowledge of the country, and we understand well the effectiveness with which the workers in the two fields may aid each other.

In establishing an "institution of learning," as directed by the founder of the Stevens Institute of Technology, they felt that its success in the field of labor chosen would become an important element in securing this corporation of science and labor, and of theory and practice, by giving to the world a class of men who should combine as effectively as possible these two important elements of successful training.

They already see proof of the correctness of their views, and they recognize in the proposed plan a means of rendering the work of the college still more effective.

They anticipate that the establishment of such an auxiliary would aid by bringing the work already in progress more fully before those who are best qualified to aid in making it more successful.

They see that good work in the direction indicated would add to the reputation of the Institute, and would assist in extending that reputation by securing the widest publication of the results of work done here.

Yours, &c.

W. W. SHIPPEN.
S. B. DOD.



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Editorial Announcements.

Addresses.—Business letters should be addressed and drafts made payable to THE RAILROAD GAZETTE. Communications for the attention of the Editors should be addressed EDITOR RAILROAD GAZETTE.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN OPINIONS, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

THE CHICAGO & ALTON.

This, the third of the Chicago companies to report its operations for the year 1873, has really something like the same story to tell. With a quite small increase in gross receipts, it has succeeded in reducing somewhat the proportion of working expenses, and the result is a considerable increase in net earnings, which for the year amount to more than 11 per cent. on the capital stock, while to pay the 10 per cent. dividend for 1872 it was necessary to use part of the surplus of the previous year.

The Chicago & Alton is similar in its situation to the Illinois Central, but with no section of it so unwisely located as the Centralia-Dunleith line of the latter, and entirely independent of other companies for outlets to the north and east. It is, moreover, not so distinctively a north-and-south line as the Chicago & Cairo line of the Illinois Central, but is more direct as a section of an all rail route between districts on its lines and the East and especially New England; moreover it has the advantage of all other railroads west of Lake Michigan in having a great city at each end of its main line, and it has also probably more coal mines, and certainly a larger coal traffic than any other railroad in Illinois. It has, however, like the Illinois Central, suffered largely by the diversion of traffic to the numerous east-and-west roads which cross its line south of Chicago, and which have mostly been constructed since the war, and a season of high lake freights is disastrous to it, as to the Illinois Central, and in a less degree to all railroads reaching Lake Michigan from the South and West. So, too, as it is interested in cheap lake rates, is it in the development of traffic to and from the South, either by the Mississippi River or by the system of railroads which has an outlet to St. Louis over the St. Louis & Iron Mountain Railroad. Through the new Louisiana & Missouri River Railroad and an alliance with the St. Louis, Kansas City & Northern it has of late secured a connection with Kansas City and the railroads beyond, which connection, however, has turned out to be of no very great importance, the Kansas traffic having greatly decreased since the time the Hannibal & St. Joseph was getting rich out of it, and this and the Rock Island Company

sent down lines to share this traffic, which had decreased largely before the new roads were completed.

Business on this and all Illinois roads was largely experimental for the last half of the year, since it was conducted under a tariff which was not only new, but founded on new principles, and those such as utterly prevented the most economical development and conduct of traffic. The result is certainly as good as could have been expected. The road has fully earned its dividend, and traffic has been somewhat increased. The amount of this increase is not evident, for the report does not give the passenger mileage and tonnage mileage, but only the number of passengers and tons of freight carried.

The Chicago & Alton Company, as organized at present, is the heir of a more unfortunate company, and its capital account of about \$45,800 per mile owned probably is not equal to the cost of the property, as it is an unusually well-built and equipped road, has a considerable amount of double track and steel rails, and equipment for five-sixths more mileage than it owns. Its bonded debt is unusually light, and there are very few companies in America whose bonds are so thoroughly well secured. Thus last year the interest charge amounted to but \$513 per mile worked, while the net earnings above rentals were \$2,474. It was at the very beginning of last Fall's panic, we believe, that it sold £300,000 of a new 6 per cent. loan, to be used for second track and renewals of rails with steel. Its financial condition once thoroughly understood, it will doubtless be able to negotiate all such loans for improvements as are demanded by increasing traffic at the very best rates.

Though there was no extension of the mileage of the roads worked by this company during the year 1873, a great and costly improvement was added in the shape of the bridge over the Mississippi at Louisiana, as costly probably as 30 miles of new road would have been, and a true measure of economy as well as an extension of facilities, inasmuch as the yearly cost of maintaining the ferry by which connection has been had heretofore has been greater than the interest on the cost of the bridge, which latter will put the line on an equality with all others at all seasons, while heretofore it has had its traffic almost destroyed for considerable periods in the winter by the difficulty or impossibility of ferrying.

Below we give a table of the net earnings per mile worked for each of the past 11 years. Since 1865 the company has paid 10 per cent. dividends yearly on both preferred and common stock:

1863.....	\$2,711	1868.....	\$5,558
1864.....	4,407	1869.....	4,652
1865.....	6,526	1870.....	4,038
1866.....	5,283	1871.....	4,179
1867.....	6,205	1872.....	2,963
	1873.....		3,268

The length of road worked was the same during the five years in the first column; but there has been some addition in the average mileage worked every year since, the new lines being various in value, and none nearly so valuable as the old main line. Of course it was not to be expected that the average net earnings per mile would be kept up with this increase of mileage, the aim being simply to have them add to the net earnings in proportion to their cost, which they probably have done, as the addition to the mileage has not been accompanied by anything like a proportionate increase in the capital account, or in rentals, which are equivalent to interest on capital cost.

A reduction of the chief items affecting the financial condition of the company to amounts per mile will make it easier to appreciate that condition, and the comparison of the amount for the two years may indicate its tendency:

Stock per mile owned.....	\$31,595	\$31,595
Bonded debt per mile owned.....	14,190	13,802
Gross earnings per mile worked.....	8,469	5,185
Net earnings.....	3,268	2,963
Interest charge.....	513	490
Rental charge.....	794	773
Surplus above interest and rental charges per mile worked.....	1,961	1,791
Stock per mile worked.....	17,493	18,024
Percentage of net surplus on stock.....	11.21	9.55

Here we have a decrease of about 3 per cent. in the stock per mile worked (owing to an increase in mileage without any increase in stock); and an increase of 14 per cent. in the disposable surplus per mile worked. The other increases per mile worked are 5 per cent. in interest charges, 3 per cent. in rentals, 3½ per cent. in gross earnings, and 9½ per cent. in net earnings.

The Chicago & Alton, like most Illinois roads, but more than almost any other, will depend hereafter to a greater extent than ever before on the development of business directly on its lines, and less on the growth of the country beyond them. Connecting as it does the two great cities of the West, one the great centre of produce shipments, and the other likely to be the great centre of iron manufacturers of the Northwest, as well as a great depot for produce shipments, it cannot fail to be a great thoroughfare; and having a row of large and prosperous towns on its route which have begun to be places of considerable manufactures, and whose direct connection with the two great distributing depots of the Mississippi Valley, together with the presence of an abundance of cheap coal, is likely to give them a leading place in the future of Western manufacturers.

Every effort of its members should be directed to collect and contribute valuable information referring to the subjects under consideration. We have so often called attention to the importance of replying to the cir-

from agricultural produce alone. Not that there is not room for a large increase in such produce and in the transportation of it, but that it is not reasonable to expect that the increase in such production will continue so rapid as it once was.

THE MASTER MECHANICS' ASSOCIATION.

With the advent of spring, the American people are in the habit of congregating together to talk about those things which are going wrong, and to devise means of setting them right. It of course is quite unnecessary to expend any time or argument to show that things generally have a persistent tendency to go wrong, and that they go right only when they are under some kind of control of law or of reason. The Master Mechanics' Association, like nearly all other deliberative organizations, has a reformatory character; that is, it seeks to determine what is wrong in the practice of the business in which its members are engaged, and then to consider and elucidate the best remedies for the evils which are presented. Its aim in fact is to create order out of disorder, to establish law where there is no government, and as far as possible bring the practice of their business under the control of right reason. When the objects of the Association are thus stated, they seem to be so general and so obvious as to sound like mere common-place, yet we believe that a little careful consideration, from this point of view, of its aim and objects will perhaps make more clear what should not be lost sight of, and what perhaps needs especially to be kept in mind this year. Any one who will take the trouble to examine into the past history of similar organizations will be surprised to learn how extremely short-lived most of them have been. Like human mortality, that of societies is greatest in childhood—that is, very few of them exist longer than a few years from their birth. It is only those which have a clearly-defined and useful purpose, and which fulfill it, that live any considerable time. At first the novelty and the pleasure of meeting people engaged in the same pursuits induce people to attend. These soon disappear, and unless there is a groundwork of sound, solid work underneath, members soon tire of the mere social diversions which usually attend all such meetings.

There is another very prolific cause which very often makes the sessions of scientific or technical societies dull and unprofitable. We refer to the discussion of mere routine business and of questions of detail.* Such matters should, as far as possible, be referred to committees with authority to act on them. Usually they are of no interest to members, who grow weary and impatient and ultimately lose interest in the proceedings.

To make the reformatory character of the Master Mechanics' Association more clear, we will illustrate it by referring to their action on several subjects which have come before them, and on which they have taken action. Take for example the sizes of locomotive tires. A few years ago the confusion caused by the great variety in the sizes of wheel-centres became apparent. Even for wheels of the same nominal outside diameter, there would be differences varying from ½ to two or three inches in the inside diameter of their tires. Great confusion, inconvenience and loss resulted from these variations, as large stocks of tires had to be kept on hand, and often it seemed as though the tires which were most certain to break or to wear out were those of which there were no duplicates on hand. This confusion could of course not be remedied excepting by mutual agreement of the master mechanics. It was therefore one of the first subjects which they took up for consideration, and after thorough discussion they fixed upon standards for the diameter of tires for wheels of different sizes. This of course will result ultimately in reducing chaos to some sort of order, although it will take considerable time to do it.

The same thing may be said for bolts, nuts and screw threads. Unfortunately, when the construction of railroads and railroad machinery was first begun, there was no standard system of screw threads, and therefore each manufacturer adopted whatever his will led him to. The result has been that it has often occurred that a different set of taps and dies were required for each maker's engines or cars. This evil the Master Mechanics' and also the Master Car Builders' Association have remedied by adopting what is called the Franklin Institute or the Sellers system of screw threads. If this system is specified for all new work, it will of course result in uniformity in time.

We have cited these examples merely to show the sort of evils which the Associations have remedied and to which their attention has been directed. By going over the whole list of subjects, it will be seen that there are other evils which need to be reformed, but which are more difficult to reach than those we have referred to. What we wish to enforce here and make as plain as possible is, that the success of the Association depends almost entirely upon the amount of work of this kind which it performs. Every effort of its members should be directed to collect and contribute valuable information referring to the subjects under consideration. We have so often called attention to the importance of replying to the cir-

culars which the various committees send out that it seems quite unnecessary to do so again. It is probable that last year there were fewer replies to the circulars than in previous years. Of course if they should continue to diminish, it is only a question of time when the Association must abandon this most excellent method of collecting information. In that event the Association would lose what has heretofore been one of its most efficient means of usefulness, and one which has been more successfully employed by it than by any similar organization that we know of. To men accustomed to transact business as promptly as master mechanics are, it is of course not necessary to enforce the well known truth that good intentions are perhaps as useless sentiments, until they are fulfilled, as human creatures can indulge in and therefore that unless they propose to add to that celebrated mosaic, with which certain undescrivable regions of habitation are said to be paved, they should reply to the circulars of the committee at once.

On another page will be found a correspondence between Professor Thurston and the Trustees of the Stevens' Institute of Technology, from which it will be seen that the latter offer to give the requisite room and care to any instruments which may be provided for making tests or experiments, as was proposed when the committee was appointed last year to consider and report on the formation of a mechanical laboratory. The offer from the Stevens Institute to give a local habitation to such a laboratory is certainly a very favorable one. The advantages which would result therefrom would not only be that a home would thus be provided, but the co-operation of the scientific skill of all the professors of that institution would thus be secured, and at the same time the confidence of the public would be gained to an extent which would be impossible with any other arrangement.

The organization of such an experimental department in connection with the Master Mechanics' Association must of course be very carefully matured, as it will be an easy matter to make a very disastrous failure of the whole project, if entrusted to improper parties, or if it is made subject to interference from irresponsible persons. The committee should therefore be very careful in making any recommendations, and should not determine on any plan until it has been carefully considered and discussed.

Record of New Railroad Construction.

This number of the RAILROAD GAZETTE has information of the laying of track on new railroads as follows:

Washington City, Virginia Midland & Great Southern.—The Danville Extension has been extended southward 10 miles to Chatham, Va.

Illinois, Missouri & Texas.—The track is laid from the Mississippi River at Cape Girardeau, Mo., westward 9 miles.

This is a total of 19 miles of new railroad, making 180 miles completed in the United States in 1874.

THE PENNSYLVANIA RAILROAD REPORT, the more important part of which we publish in this number, reached us too late to be examined with any care this week. It contains a great amount of matter of general interest, not the least of which is the statement of the cost (working expenses) and receipts per ton and per passenger per mile on the different roads worked by the company.

At the stockholders' meeting, the directors presented resolutions, which were passed, calling for a committee of seven, to be appointed by the Chairman of the meeting (Mayor Stokley) to investigate thoroughly the condition and management of the company, appraise its property of all kinds, and examine into its liabilities, including all its guarantees of other lines, and to report thereon at a future meeting to be called by them.

THE NATION, which has shown unusual clear-headedness in discussing railroad questions as in all other questions which it treats, should have been credited with the article entitled "Railroad Evolution," which we published in our issue of February 28.

THE SCRAP HEAP.

Railroad Manufactures.

The Grant Locomotive Works at Paterson now have 425 men employed, and more are being taken on daily.

The Schenectady Locomotive Works have commenced running a force of 250 men.

The Manchester Locomotive Works which have been running seven hours daily since December 1, commenced running full time March 1.

The Superior Rail Mill, at Allegheny City, Pa., which has been closed for some months, has started up again with a heavy order for rails for the Allegheny Valley Railroad.

The sum of \$100,000 has been subscribed to secure the establishment of a locomotive shop at Rochelle, Ill.

Prices of Rails in February.

Bigelow & Johnston report foreign iron rails at \$58 to \$60 gold per ton, sales of but one or two small rails in bond, and no import at New York. American rails were \$60 to \$65 currency, low offers on the part of the mills and a great lack of business. Foreign steel rails were \$103 to \$105 gold, with imports of 4,774 tons at New York; American were \$100 to \$105 currency; and there was considerable inquiry. Old rails were \$45 for double-heads and \$40 for T, and there was a moderate demand. The exports since 1873 at New York were: 9,686 tons of steel against 8,771 in 1873, no iron against 5,376 in 1873, and 65 old rails against 2,729 last year.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

At the annual meeting of the Housatonic Railroad Company in Bridgeport, Conn., February 27, the following directors were elected: William H. Barnum, Lime Rock, Conn.; George W. Peet, Falls Village, Conn.; Andrew B. Mygatt, New Milford, Conn.; Horace Nichols, Bridgeport, Conn.; David S. Draper, Great Barrington, Mass.; Henry S. Leavitt, Samuel Willits, Charles P. Peck, New York. The board subsequently re-elected the old officers, as follows: President, William H. Barnum; Vice-President, David S. Draper; Secretary and Treasurer, Charles C. Averill; Superintendent, H. W. Franklin.

The Middlesex County (Conn.) Superior Court has appointed George H. Bishop and John N. Camp trustees for the bondholders of the New Haven, Middletown & Willimantic Railroad Company, in place of Messrs. Coffin and Galpin, resigned.

The following officers have been appointed for the Des Moines & Fort Dodge Railroad: Superintendent, Charles W. Gillmore; General Freight and Passenger Agent, George W. Ogilvie; Land Commissioner, George B. Smyth.

At the annual meeting of the Memphis, Carthage & Northwestern Railroad Company in Carthage, Mo., March 3, the following directors were elected: R. W. Wright, E. Miller, W. S. Tower, Carthage, Mo.; James K. Baker, A. A. Talmage, C. W. Rogers, St. Louis; J. Seligman, J. M. Brown, J. M. Hyde, New York. At meeting of the board, James K. Baker was chosen President, R. W. Wright, Vice-President, and E. Miller Secretary and Treasurer.

At the annual meeting of the Central Railroad Company of Long Island recently, the following directors were elected: H. C. Poppenhusen, A. Poppenhusen, Hugo Funke, Hermann Funke, Henry Karstedt, College Point, N. Y.; E. B. Hinckle, Loomis L. White, Flushing, N. Y.; John D. Locke, Whitestone, N. Y.; Karl Victor, Charles A. Hoyt, F. A. Barker, Iwan Van Awan, New York City.

At the annual meeting of the Bell's Gap Railroad Company in January the following officers were elected: President, A. L. Mayfield, Philadelphia; directors, Edward Y. Townsend, Samuel G. Lewis, John H. Converse, T. J. Heizman, Philadelphia; John Reilly, Altoona, Pa.; Secretary and Treasurer, J. G. Cassatt, Philadelphia. Jos. Ramsay, Jr., Antestown, Pa., is Superintendent of the road.

At the annual meeting of the Cleveland, Columbus, Cincinnati & Indianapolis Railway Company in Cleveland, O., March 4, 135,000 shares out of 156,000 were voted on and the following directors were elected: J. H. Devereux, H. B. Hurlbut, Stillman Witt, R. P. Ranney, L. M. Hubby, W. S. C. Otis, R. M. Shoemaker, Cleveland, O.; H. E. Parsons, W. H. Upson, Ashtabula, O.; S. L. M. Barlow, P. H. Watson, F. Schuchardt, William Butler Duncan, New York. The new directors are Messrs. Otis and Upson, who replace Gen. G. B. McClellan and Mr. T. P. Handy. Messrs. Upson, Devereux and Parsons are directors of the Atlantic & Great Western; Mr. Watson is President and Messrs. Barlow, Duncan and Schuchardt are directors of the Erie, the Erie and Atlantic & Great Western party having succeeded in electing their board. The ticket voted by the opposition carried the following names: James M. Brown, Amasa Stone, Jr., Royal Phelps, Walton Ferguson, J. H. Wade, W. J. Boardman, William Collins, Francis Leland, Melanchthon Barnett, Stillman Witt, David Kilgore, B. F. Wade, B. S. Brown.

The President of the United States has appointed James F. Wilson, of Iowa; J. H. Willard, of Nebraska; John C. S. Harrison, of Indiana; John A. Tibbets, of Connecticut, and Francis C. Brewer, of New York, Government directors of the Union Pacific Railroad Company for one year from March 11.

Mr. George A. Merrill, Superintendent of the New London Northern, and formerly of the Rutland & Burlington Railroad, has been appointed Superintendent of the Connecticut & Passaic Rivers Railroad, in place of Mr. William M. Parker, who goes to the Boston & Lowell road.

The Massachusetts Legislature in joint meeting recently elected Joseph H. Chadwick, of Boston; Lewis R. Norton, of Westfield, and Charles L. Wood, of New Bedford, State directors in the Boston & Albany Railroad Company.

At the annual meeting of the Union Railroad Company of St. Louis, March 3, the following directors were elected: Julius S. Walsh, Yoder Brown, B. Gratz Brown, A. B. Easton, John P. Helfenstein, John A. Walsh.

At the annual meeting of the Atchison & Nebraska Railroad Company in Atchison, Kan., March 3, the following directors were elected: George Putnam, Jr., Atchison, Kan.; James F. Joy, Detroit, Mich.; Nathaniel Thayer, H. H. Hunnewell, James H. Beal, Charles T. Young, John S. Burnham, William F. Weld, Charles Merriam, Nathaniel Thayer, Jr., Boston; John A. Stewart, New York.

At the annual meeting of the Chicago, Millington & Western Railroad Company recently the following directors were chosen for the ensuing two years: James W. Eddy, Millington, Ill.; S. G. Paddock, Princeton, Ill.; S. Dorr, Neponset, Ill.; Charles L. Hoyt, Aurora, Ill. George N. Jackson, Chicago, Ill., was chosen for one year to fill the vacancy made by the resignation of J. S. Rumsey. The board elected officers as follows: President, Lewis Steward, Plano, Ill.; Vice-President, James W. Eddy; Secretary, George N. Jackson.

The board of directors of the Utica, Chenango & Cortland Railroad Company met in Cortland, N.Y., March 4, and elected the following officers for the ensuing year: Hon. Ezra Cornell, President; Gen. Wm. L. Burt, Vice-President; Norman Chamberlain, Secretary and Treasurer; Horatio Ballard, Attorney; H. P. Goodrich, Superintendent.

Mr. Edward Vernon, formerly General Ticket Agent of the St. Louis, Terre Haute & Indianapolis Railroad, the founder and until a year and a half ago the editor of the *Traveller's Official Guide*, and also the founder and present editor of the *American Railroad Manual*, has been appointed Vice-President of the Arkansas Central Railway Company, with office in New York.

Mr. Charles M. Pond, of Hartford, Conn., has been chosen Vice-President *pro tem.* of the New York, New Haven & Hartford Railroad Company, in place of W. P. Burrall, deceased.

The Martha's Vineyard Railroad Company has been temporarily organized by electing E. P. Carpenter President, and Joseph T. Pease, Treasurer.

TRAFFIC AND EARNINGS.

The anthracite coal tonnage of the lines given (whose business year begins December 1), for the three months ending February 28 was as follows: Philadelphia & Reading Railroad, 1874, 914,146 tons; 1873, 904,793 tons; increase, 9,358 tons, or 1% per cent. Lehigh Valley Railroad, 1874, 763,665 tons; 1873, 751,227 tons; increase, 12,438 tons, or 1% per cent. Pennsylvania & New York Railroad, 1874, 150,649 tons; 1873, 133,582 tons; increase, 17,117 tons, or 12% per cent. Pennsylvania & New York, bituminous coal, 1874, 54,956 tons; 1873, 50,583 tons; increase, 4,373 tons, or 8% per cent.

The anthracite coal tonnage of the lines given for the two months ending February 28 was as follows: Delaware, Lacka-

wanna & Western, 1874, northward, 95,994 tons, southward, 263,821 tons, total, 349,815 tons; 1873, northward, 106,465 tons, southward, 305,455 tons, total, 411,920 tons; total decrease, 62,105 tons, or 15% per cent. Central Railroad of New Jersey, Lehigh & Susquehanna Division, 1874, 140,945 tons; 1873, 206,439 tons; decrease, 155,494 tons, or 62% per cent. Delaware & Hudson Canal Company's lines, 1874, 288,700 tons; 1873, 435,940 tons; decrease, 147,240 tons, or 33% per cent. Pennsylvania Coal Company, over Erie Railway, 1874, 167,779 tons; 1873, 117,782 tons; increase, 49,997 tons, or 42% per cent. Northern Central, Shamokin Division, 1873, 64,863 tons; 1873, 79,769 tons; decrease, 14,906 tons, or 18% per cent. Summit Branch Railroad, 1874, 36,378 tons; 1873, 41,559 tons; decrease, 4,680 tons, or 11% per cent.

The earnings of the Huntingdon & Broad Top Railroad for the year 1873 were:

Earnings (\$7,397 per mile).....	\$431,107 47
Expenses (66.44 per cent).....	241,102 92

Net earnings (\$3,299 per mile)..... \$190,004 55
As compared with 1872 there is an increase of \$120,154.93, or 38% per cent. in gross earnings, and \$66,170.35, or 53% per cent. in net earnings.

The reported earnings of the Central Pacific Railroad for the month of February were: 1874, \$794,000; 1873, \$685,641; 1872, \$571,836; increase, 1874 over 1873, \$108,359, or 15% per cent.; increase, 1874 over 1872, \$22,164, or 38% per cent. For the two months ending February 28, the earnings were: 1874, \$1,642,558; 1873, \$1,581,284; 1872, \$1,164,059; increase, 1874 over 1873, \$61,274, or 3% per cent.; increase, 1874 over 1872, \$478,499, or 41% per cent.

The shipments of bituminous coal over the lines given for the two months ending February 28 were as follows: Huntingdon & Broad Top, 1874, 62,065 tons; 1873, 72,834 tons; decrease, 10,769 tons, or 14% per cent. Clearfield coal over Tyrone Division, Pennsylvania Railroad, 1874, 100,582 tons; 1873, 54,861 tons; increase, 45,721 tons, or 83% per cent.

The shipments of Cumberland coal over the lines given for the two months ending February 28 were: Baltimore & Ohio, 1874, 173,691 tons; 1873, 197,567 tons; decrease, 24,866 tons, or 12 per cent. Bedford Division, Pennsylvania Railroad, 1874, 22,293 tons; 1873, 15,370 tons; increase, 6,863 tons, or 44% per cent.

The earnings of the Great Western Railway of Canada for the week ending February 13 were: 1874, \$22,569; 1873, \$24,189; decrease, \$1,690, or 6% per cent.

The earnings of the Grand Trunk Railway for the week ending February 14 were: 1874, \$29,300; 1873, \$21,900; increase, \$7,400, or 23% per cent.

For the six months ending November 30 the net earnings of the Oregon & California Railroad were: 1873, \$179,584.10; 1872, \$104,707.52; increase, \$75,176.58, or 71% per cent.

The earnings of the Cincinnati, Hamilton & Dayton Railroad for the six months ending September 30, 1873, were:

Earnings.....	\$625,287 50
All expenses.....	484,495 31

Balance \$140,742 59

The earnings of the Bridgeport & Port Norris Railroad for the year 1873, the first since its completion, were:

Earnings (\$1,197 per mile).....	\$25,100 08
Expenses (96.44 per cent).....	23,732 98

Net earnings (\$67 per mile)..... \$1,397 10

The following companies have thus far reported earnings for February:

	1874.	1873.	Inc.	Dec.	P. ct.
Atlantic & Great Western	\$344,257	\$360,754			16,497
Central Pacific	794,000	865,641	\$108,559		15%
Chicago & Northwestern	900,021	765,249	137,772		18
Erie	1,273,775	1,323,901		50,126	3%
Illinois Central	536,668	597,429		58,761	9%
Indianapolis, Bloom. &					
Western	129,904	90,441	38,863		48
Lake Shore & Michigan					
Southern	1,305,132	1,592,754		287,622	18 1-16
Marietta & Cincinnati	144,215	162,586		18,370	11 1/4
Milwaukee & St. Paul.	657,500	423,716	233,784		55 1/4

The earnings of the Detroit & Milwaukee Railroad for the year 1873, were:

Earnings (\$6,375 per mile).....	\$1,204,577 57
Operating expenses (98.46 per cent).....	1,186,948 12

Net earnings (\$98 per mile)..... \$18,534 25

Insurance and taxes..... 41,260 47

Interest and exchange..... 403,209 46

Total..... \$444,469 93

Deficiency..... \$425,935 68

The gross earnings show a decrease from 1872 of \$179,255.17, or 13% per cent.

During the month of February the Bingham Canon Railroad carried 4,310 tons of freight.

PERSONAL.

At a recent meeting of the directors of the Syracuse Northern Railroad Company, the President, Mr. J. J. Belden, tendered his resignation, which the board refused to accept, urging him to continue in the management of the affairs of the road.

Mr. John S. Patten, formerly Agent of the Erie Railway and later of the Erie & North Shore Line in Detroit, Mich., died in that city February 3, at the age of 41.

CHICAGO RAILROAD NEWS.

Illinois Central.

The Land Department reports for February sales of 2,761.37 acres construction lands for \$22,994.12, 120 acres free lands for \$1,432 and town lots for \$50, a total of 2,881.37 acres for \$24,476.12. Cash collections amounted to \$38,793.16.

The Traffic Department reports for February as follows:

	In Illinois,	In Iowa,	Total
Freight.....	707 miles.	402 miles.	1,109 miles.
Passengers.....	28,531 00	50,592 00	\$343,123 00
Mails.....	66,633 00	26,811 40	113,445 00
Other sources.....	6,375 00	3,059 32	9,434 32
Total, February, 1874.	\$446,464 69	\$92,233 40	\$538,698 00
Actual earnings, February, 1873.....	506,347 17	91,081 71	\$57,428 88

This shows a decrease of 11% per cent. in the Illinois earnings; an increase of 1% per cent. in the Iowa earnings; and a decrease of 9% per cent. in the total earnings.

OLD AND NEW ROADS.

Kansas Pacific.

A circular to the bondholders has been issued giving the particulars of an agreement made with committees representing the bondholders in Frankfort, Bremen and Amsterdam, and asking the assent of the American bondholders thereto. The agreement provides that two coupons, including that of November 1, 1873, shall remain unpaid, and that one-half of the amount of the five next coupons shall be paid as each matures.

and thereafter the company shall resume payment in full. The coupons wholly or partially unpaid shall be held by some German bank as trustee (a bank in New York will be designated as trustee for American bondholders), and certificates of indebtedness bearing 6 per cent. interest and payable in the order of their drawing, beginning in 1876 and ending in 1886, will be issued for the coupons. The German bondholders are to designate two houses in New York and St. Louis, and one member of each house is to become a director of the company, and these two directors are to have the supervision of the financial affairs of the company, and without their consent no expenditure shall be made for new work or new lines and no new floating debt shall be contracted. In case the revenue affords a surplus over the sum required for the bonds and certificates, it shall be used for canceling the certificates, and no dividends on stock or coupons on the income bonds shall be paid until the certificates are all paid. An office is to be opened in Frankfort for the delivery of certificates and transaction of other business under the agreement. As fast as securities now in the hands of floating-debt creditors are released, they shall become additional securities for the bondholders.

New York & Chicago Midland.

Messrs. Heidelbach, Frank & Co., having received replies to their former circular from a large proportion of the American bondholders, have placed the interests of the first-mortgage bondholders in the hands of a committee consisting of Mr. David Salomon, President of the German-American Bank of New York; Mr. Charles A. Davison, of the law firm of Burrall, Davison & Burrall, and Mr. E. L. Frank, of their own firm.

This committee has issued a circular impressing on the bondholders the necessity of pressing to a final decree as soon as possible the suit now pending for a foreclosure of the first mortgage. None of the plans of reorganization proposed seems to secure to the first-mortgage bondholders the rights due to their priority of lien, and, the committee says, there is little doubt that their wisest course will be to buy in the road and reorganize in their own interest. Bondholders desiring to unite with those already represented by the committee must deposit their bonds with the Farmers' Loan & Trust Company, New York, by March 20. They will also be required to deposit to the credit of the company one-half of one per cent. of the face of their bonds to pay legal and other necessary expenses.

Alabama & Chattanooga.

Under order of the Circuit Court of the United States for the Fifth Judicial Circuit this road is to be sold at public sale in Mobile, Ala., May 4. The order is made at the suit of the trustees for the first-mortgage bondholders. No bid will be received for less than \$5,220,000. The purchaser must pay \$200,000 in cash on the acceptance of his bid, and the balance in 60 days. Of this balance \$1,200,000 may be paid in receivers' certificates issued under orders of the court, and any or all of it may be paid in first-mortgage bonds, to be taken at such a price as will equal the dividend to which they are entitled by decree of the court. Bonds tendered in payment must have received the sanction of the court.

The road is 205 miles long, from Chattanooga, Tenn., southwest to Meridian, Miss.

Cleveland, Columbus, Cincinnati & Indianapolis.

The annual meeting at Cleveland, March 4, called out an unusually large proportion of the stock, 132,946 shares out of 150,000, or nearly 90 per cent. of the stock, being voted on. The ticket which was successful received 74,494 votes, a majority of 16,042 over the opposition, though not quite a majority of the whole stock. The board elected varies very little from that of last year, and is in the Erie and Atlantic & Great Western interest. The election shows, however, that interest has not control of stock enough to secure the approval of a lease, which requires two-thirds of all the stock.

Pennsylvania.

Notice is given that the third and final installment of 25 per cent. (\$12.50 on each share) on the new stock of 1873 will be due and payable between May 1 and 28, 1874.

Cherokee.

The Superintendent of this railroad (formerly the Cartersville & Van Wert), Mr. D. W. K. Peacock, informs us that the line, which has been classed with 3-foot gauge roads, is of 5-foot gauge from Cartersville, Ga., (the junction with the Macon & Western), northwestward 14 miles, and the rest of it, 8 miles, of 3-foot gauge.

The Fortieth Parallel Railroad Convention.

A convention numbering about 150 delegates, mainly from Illinois, was held in Springfield, Ill., March 4. Resolutions were adopted urging Congress to adopt such measures as will secure the construction of a railroad from the Atlantic seaboard to Denver, Col., on a line near the 40th parallel, with branches to the principal Atlantic cities, and also to St. Louis, Chicago, Cincinnati, Toledo and other Western cities. A committee of 50 was appointed to draw up a bill for a charter for such a road, and to take other steps to forward the object of the convention.

Pacific Mail.

A quit-claim deed, releasing the Howe Sewing Machine Company's property from the mortgage made by its President, A. B. Stockwell, to the Pacific Mail Steamship Company to secure the payment of \$1,140,000, has been filed for record at Bridgeport, Conn.

New York Central & Hudson River.

This company advertises for proposals for laying and ballasting the two additional tracts from Albany to Rochester. Specifications can be seen at the office of the Chief Engineer in Albany, and also at the offices of the assistant engineers on the line. Proposals will be received until March 16, and must be sent to Mr. Charles H. Fisher, Chief Engineer, Albany, N. Y.

A number of freight-train crews have been discharged from the Western and Eastern Divisions. There is said to be much dissatisfaction among the train-men, and there is some fear of a strike on the Western Division.

Galveston, Houston & Henderson.

The difficulties between this company and the Houston & Texas Central have been amicably adjusted, and the Central Company has caused the order as to through bills of lading to be modified so as to remove the objectionable features.

Memphis & Charleston.

Memphis papers mention reports to the effect that there will be shortly a change in the management or control of this road.

New Jersey Southern.

A locomotive, one passenger and 33 freight cars belonging to this company, which were in use on the Smyrna & Delaware Bay road in Delaware, were sold at Sheriff's sale, March 5, for about \$20,000.

Logansport, Crawfordsville & Southwestern.

A circular addressed to the bondholders asks them to fund the coupons from November 1, 1873, to February 1, 1876, both inclusive, in ten-year certificates bearing interest at 7 per cent. in gold and dated February 1, 1874. The coupons are to be held in trust by the Farmers' Loan & Trust Company of New York, as security for the payment of principal and in-

terest of the certificates. The road is encumbered with a heavy floating debt, and it is necessary for the company to liquidate this in order to be able to operate the road to advantage.

Peachbottom.

This company intends to issue 7 per cent. bonds to the amount of \$400,000, to furnish funds for completing the work of track-laying, for the construction of a bridge over the Susquehanna to connect the eastern and western divisions of the road, and for the purchase of equipment.

Jackson, Lansing & Saginaw.

The stockholders held their annual meeting in Jackson, Mich., March 4, and without electing directors adjourned to April 1.

Considerable complaint is made by shippers on the northern part of the line both as to high rates and insufficient accommodations. A number of stations have recently been discontinued above Standish.

Washington City, Virginia Midland & Great Southern.

The Danville Extension is completed to Chatham, in Pittsylvania County, Va., some 46 miles from Lynchburg and 10 miles beyond the last point noted. Trains will be put on from Lynchburg to Chatham shortly.

Guyahoga Valley.

About 300 men have been employed on this road during the past season, and work has been pushed forward as fast as the weather would permit. The grading from Akron, O., south by east to Canton, some 22 miles, is nearly completed, and work is progressing on the masonry.

European & North American.

The Maine Legislature has passed the act legalizing the consolidation of the Maine and New Brunswick companies of this name, which was arranged some time since. The law requires that of the 13 directors of the company five must be residents of the city of Bangor, Me., and five of the province of New Brunswick.

Wilmington, Charlotte & Rutherford.

By order of the Superior Court of New Hanover County, N. C., the holders of the first-mortgage bonds of this old company (now replaced by the Carolina Central) are allowed until April 1, 1874, to present their bonds for payment in Wilmington, N. C. In case of failure to do so they will be excluded from the benefit of the decree in the action of foreclosure.

Great Western, of Canada.

The Company's Chief Engineer has been making an examination of the Niagara River in the neighborhood of the Suspension Bridge, with a view to the construction of a new double-track iron bridge for the use of the road, instead of the present bridge.

Cincinnati & Terre Haute.

The Indiana Courts have awarded possession of the road to the bondholders, and Mr. Josephus Collett has been appointed their agent to operate the road temporarily. It is completed for 26 miles, from Terre Haute, Ind., southwest to Middlebury.

Railroad Legislation in Iowa.

Both houses of the Iowa Legislature have passed the bill for the regulation of rates of fare and freight. The bill divides the railroads of the State into three classes, of which the first is allowed a maximum rate of three cents per mile for passengers; the second $\frac{3}{4}$ cent, and the third $\frac{1}{4}$ cent. It contains a printed schedule of freight rates, and railroads of the first class must charge 10 per cent. less than the schedule rates; the second class 5 per cent., and the third class 20 per cent. above the schedule. Penalties are provided and an appropriation is made to enable State officers to prosecute for violations of the law.

American Railroad Manual.

The office of this publication has been removed from No. 3 Park place to No. 56 Broadway, New York.

Forced Sales of Bonds.

At an auction in New York, on the 4th, the following sales were made:

\$100,000 Mobile & Alabama Grand Trunk Railroad Company 1st mortgage 8 per cent. bonds, due 1900. Interest January and July. Guaranteed by the State of Alabama.....	40
22,500 Cincinnati & Terre Haute Railroad Company, 1st mortgage 7 per cent. gold bonds, with full coupons attached from August 1, 1872, inclusive; coupons February and August; \$500 each.....	8½
210,000 Toledo, Peoria & Warsaw Railroad Company, 2d mortgage 7 per cent. bonds (Western Division), interest April and October, hypothecated, \$1,000 each.....	55½
590 shares Toledo, Peoria & Warsaw Railroad Company, common, hypothecated, \$100 each.....	\$1.50 per share

Shreveport & Southwestern.

A correspondent at Shreveport, La., writes concerning this company, which was organized by some prominent merchants of Shreveport in May or June last year to build a railroad from Shreveport, La., southwestward about 40 miles to Logansport, on the Sabine River. Our correspondent reports that the President of the company, whom he characterizes as "a sharp, shrewd Yankee-Irishman," soon raised money to begin work, and the surveys and location were completed when the epidemic of yellow fever at Shreveport put an end to further work, and, in the minds of most men, of the company. But the President meanwhile canvassed the subject of an extension of the road through Texas, and he so far succeeded as to obtain charters with grants of 16 square miles of land per mile for a line from Logansport nearly due south to Sabine Pass, which is on the Gulf at the line between Louisiana and Texas; and for a line from Logansport westward through Nacogdoches, Crockett, Bremond and Belton and southwestward to the mouth of the Rio Grande at the mouth of the Rio Pecos. There is to be a consolidation of all the companies under the three charters directly.

Union Pacific.

It is stated that it is the intention of the board of directors to fund the income bonds which mature in September next in new 8 per cent. bonds, and that an additional amount of these bonds will be sold sufficient to free the company entirely from floating debt. The net earnings of the company, beginning with the current year, will then be used to pay dividends on the stock.

Long Branch & Sea Shore.

The stockholders of this company, whose road extends from Long Branch, N. J., northward to Sandy Hook, and has for some time been leased and worked by the New Jersey Southern, have applied to the Court of Chancery to recover possession of their property, which is now in the possession of the Receiver of the New Jersey Southern.

New York & Long Branch.

It is reported that a compromise has been agreed upon, by which the Pennsylvania Railroad Company agree to withdraw its opposition to the bridge over the Raritan at Perth Amboy, N. J., on condition that certain alterations are made, which will improve the navigation of the river.

Oregon & California.

An agreement has been made between Mr. Holladay and the company on one side, and the bondholders on the other. The

latter are to appoint their own financial agent and three directors and to have the entire financial control. All net earnings are to be paid to the bondholders unless the amount exceeds 7 per cent. on the bonds. For the next five years Mr. Holladay agrees to pay an amount which, with the net earnings will be sufficient to pay 2½ per cent. interest on the bonds, provided not more than \$50,000 annually is required from him; for three years thereafter he is to make up the amount to 3½ per cent. on the bonds, provided also not more than \$50,000 is needed. Messrs. Sulzbach Brothers guarantee Mr. Holladay's performance of his part of the agreement for three years. The European & Oregon Land Company is to be dissolved and the land re-converted to the railroad company under conditions that bonds shall be received in payment for lands, and that all cash proceeds of land sales shall be used for the immediate redemption of bonds.

Boston, Clinton & Fitchburg.

The stockholders have voted unanimously to ratify the lease of the New Bedford Railroad, as consolidated with the Taunton Branch. The lease has 49 years and two months to run, and the rental to be paid is 8 per cent. on the stock. The New Bedford road was leased nearly a year ago, but the consolidation with the Taunton Branch Company made a new lease necessary. The Boston, Clinton & Fitchburg Company now operates the whole line from Fitchburg and Lowell to New Bedford.

Eastern.

The outward-bound freight house of this road at East Boston, Mass., took fire about noon of March 4, and was entirely destroyed with a large quantity of freight and some 30 cars. The house was 300 feet long, partly of brick and partly of wood. The loss is estimated at about \$60,000.

Illinois, Missouri & Texas.

Iron is laid on this road from Cape Girardeau, Mo., westward nine miles. Contracts have been made for iron for 20 miles additional, and the work is to be pushed forward.

Lancaster & Reading.

The board of directors has approved the contract with the Philadelphia and Reading Company, by which the latter company agrees to guarantee the bonds and assume the existing debt of the company, and to lease the line from Lancaster to Quarryville, when completed, for a rental of 30 per cent. of the gross receipts.

Bell's Gap.

This road has been in operation since last July from Bell's Mills, seven miles east of Altoona, on the Pennsylvania Railroad, to Lloyd, a distance of 8½ miles. The road is of 3-foot gauge, is laid with rails of 35 pounds to the yard, and has an equipment of two engines, one passenger car, four flat and 100 coal cars. Its main traffic is carrying coal and lumber to the Pennsylvania Railroad.

Canada Southern.

It is stated that 12 palace cars built for this company were sold recently to the Wagner Sleeping Car Company for \$9,000 each, being a loss of \$3,000 on each car. The sale, it is said, served to relieve the company from some pressing liabilities.

Pennsylvania & New York.

The brakemen on this road have struck for an increase of wages, and the running of trains is temporarily stopped. The company has offered to pay the same wages as previous to the reduction made last fall, but the strikers demand a further increase of 10 cents per day.

Dividends.

The Nashville, Chattanooga & St. Louis Railroad Company has declared a semi-annual dividend of 2 per cent. on the consolidated stock, out of the earnings of the last six months.

The New York Central and Hudson River Railroad Company has declared the usual semi-annual dividend of 4 per cent., payable April 15. Transfer books will be closed March 14 and reopened April 20.

Meetings.

The annual meeting of the Shenandoah Valley Railroad Company will be held, pursuant to adjournment, in Front Royal, Va., April 7, 1874.

St. Croix Land Grant.

After some hesitation, the Governor of Wisconsin finally approved the bill dividing this grant between the North Wisconsin and the Chicago & Northern Pacific Air Line companies.

Wisconsin Railroad Legislation.

The Wisconsin State Senate has passed what is known as the "Potter" railroad bill, which provides for the division of the roads into three classes, and the fixing of rates of fare and freight for each class, and also for the classification of freight. It also provides for three commissioners to see to the enforcement of the law and also to inquire into and report on the condition, earnings, etc., of the railroads of the State.

Erie.

The London Banking Association has offered in London £3,000,000 (\$15,000,000) of the new second-mortgage 7 per cent. bonds. The whole amount of these bonds authorized is \$40,000,000, of which \$10,000,000 are set aside to be exchanged for the same amount of outstanding convertible bonds. The present issue is offered at 78, or £156 for a £200 bond. The books for subscription to the loan were to be open from March 9 to March 12.

There has been a serious strike among the employees of the road in Buffalo, including the workmen in the repair shops, the hands in the freight yard and the trackmen to the number of about three hundred. The men in the shops struck mainly on account of irregularity and delay in paying wages, but the trackmen desired also a restoration of their pay to the amount received before the panic. The Paymaster having arrived in Buffalo and paid the men the wages due them for the month of January, about half of them returned to work. The remainder were to be paid off and discharged. The men claim that they have been badly treated, having been obliged to wait two months for their pay.

The Boston & Maine and Eastern Controversy.

The agreement between the Boston & Maine and Eastern companies, the outlines of which were settled some weeks ago, was finally signed March 6. Competition in every form for freight and passengers is to cease, and 40 per cent. of the receipts on business from competing points will be divided between the two companies. A joint committee of the two boards will have a general supervision of the through and competing business.

Boston, Revere Beach & Lynn.

A meeting of the stockholders of this new company was held in Boston, March 7. It was voted to fix the capital stock at \$135,000, and to build the road of standard gauge, instead of narrow gauge, as at first proposed.

The Minnesota Railroad Law.

The Minnesota Legislature has passed a bill which provides for the appointment of a new Board of Railroad Commissioners, superseding the present Commissioner, which is to have a general supervision of the railroads and is also to make schedules of freight rates, which, like those of the Illinois Commission, are to be *prima facie* evidence of what are reasonable charges. They are also to receive complaints and are to have

authority to order suits for violation of the law, to be instituted by the Attorney-General of the State, or county attorneys. They will also have power to require companies to receive cars from connecting roads and to fix terms on which such cars shall be transported. They will be required to make annual reports, and have authority to require returns from companies at stated times.

Lake Shore & Michigan Southern.

In New York, March 10, \$1,000,000 of the new second-mortgage bonds of this company were sold at auction for account of the company and were purchased at 90, it is said by Commodore Vanderbilt. They bear interest from December 1 at 7 per cent.

Rochester, Nunda & Pennsylvania.

Nearly \$350,000 in subscriptions have been secured to the capital stock of the construction company which is being organized to complete this road.

Blue Ridge.

This road is advertised to be sold in Charleston, S. C., May 14, by order of the United States District Court, under proceedings in bankruptcy. The sale includes the completed road, also right of way and partly finished grading, several parcels of land and a controlling interest in the Blue Ridge Railroad Company of Georgia, the Pendleton Railroad Company and the Tennessee River Railroad Company. The sale also includes the property of those companies. Payment, except such amount as is required to pay the bankruptcy costs and taxes, may be made in first-mortgage bonds and/or coupons.

About 33 miles of the road is in operation, from Anderson, S. C., northwest to Walhalla, and a great deal of costly work has been done on tunnels and other grading beyond that point. The stock is mainly owned by the State of South Carolina and the City of Charleston.

Wabash & Erie Canal.

At a meeting held in Lafayette, Ind., March 6, the board of managers finally resolved to surrender the lease of the canal, the surrender to date back to January 1.

Milwaukee & St. Paul.

A circular issued to the stock and bondholders, whose consent is necessary to the new consolidated mortgage for \$35,000,000, gives a condensed statement of the operations for 1873. The earnings and expenses were as follows:

Gross earnings.....	\$9,046,123 57
Operating expenses.....	5,380,879 28
Net earnings.....	\$3,665,244 29
Interest on bonded debt.....	1,927,926 00
Surplus.....	\$1,738,218 29
Amount of proposed dividend on preferred stock.....	260,000 00
Surplus.....	\$1,478,218 29
The amount expended for permanent improvements during the year was:	
For 5,677 1/2 tons steel, and 5,834 tons iron rails in excess of ordinary renewals.....	\$1,213,681 05
Additional grounds and buildings in Chicago.....	462,168 19
Additional grounds and buildings at Milwaukee, Austin, Sabula and St. Paul.....	25,733 35
Docks and canals at Milwaukee.....	8,941 45
La Crosse bridge and La Crescent connection.....	104,682 64
New fences in Iowa and Minnesota.....	30,737 24
Right of way.....	5,617 59
New equipment.....	550,915 86
Total.....	\$2,402,377 47

Of this amount \$245,000 was paid from proceeds of the sale of 10 per cent. bonds. It is proposed that the balance, \$2,157,077.47, be repaid to the company from the sale of the consolidated bonds, enabling the company to apply the net earnings to the payment of cash dividends. It is proposed hereafter to pay for all permanent improvements by the sale of these bonds.

The \$35,000,000 consolidated bonds, as heretofore stated, \$26,225,000 are to be used to take up the present bonded indebtedness, leaving \$8,775,000 for improvements, which are to include steel rails where needed; bridges over the Mississippi at La Crosse, Prairie du Chien and Sabula; new elevators and new equipment. Of the new bonds, \$10,000,000 are to be in sterling 6 per cent. bonds, convertible at pleasure into 7 per cent. currency bonds.

Hoosac Tunnel Line.

The Hoosac Tunnel Line is the subject of a majority and a minority report from the joint committee of the Massachusetts Legislature, the minority, however, consisting of but a single member. The majority report covers a bill which provides for the creation of a board of trustees in which is to be vested the property and franchises of the Troy & Greenfield Railroad and the Hoosac Tunnel. The trustees are to proceed to negotiate for the merging in the trust of the Vermont & Massachusetts, the Fitchburg and the Troy & Boston roads on the basis of an equation of traffic capacity. Other roads interested may be allowed to come in. In case any of these companies refuses to merge its property in the trust, the trustees are to be authorized to lease such road, to make running arrangements with, or, as a last resort, to acquire control of it by purchase of shares. The trust property is to be represented by an issue of certificates, which will be much the same as shares in ordinary corporations.

The bill presented by the minority provides for the consolidation of all the companies whose roads form the tunnel line, the State to keep possession of the tunnel and the Troy & Greenfield road, and to hold the same open to the traffic of all connecting lines.

The majority bill will doubtless meet with strong opposition from the party which last year opposed State management, for a modified form of which the present measure provides, as the State is to have a majority of the board of trustees.

Shenandoah Valley & Ohio.

This company desires to obtain leave to extend its road (now in course of construction) from the Shenandoah Valley eastward to some point on the Potomac.

Richmond & Trans-Allegheny.

The charter of this company has passed the Virginia Legislature and been approved by the Governor. The road is to extend from Richmond west by south by Pound Gap on the Kentucky Line, with an easterly branch to Norfolk and several short branches in the western part of the State. It is to be of 3-foot gauge.

James River & Kanawha Canal.

This company proposes to make a loan of \$2,000,000, for the purpose of extending its canal from its present terminus at Buchanan, Va., northwest to Clifton Forge, and if possible to Covington.

Pacific Traffic.

At a conference in Chicago, between Messrs. Stubbs and Vining, General Freight agents of the Central and Union Pacific Railroads and the agents of the Chicago roads, an agreement was made under which the roads will work together as heretofore, dividing the earnings on through freight *pro rata* as desired by the Chicago roads. The rates agreed upon from Chicago to San Francisco are: first class, \$3.50 per 100 lbs.; second class, \$3; third class, \$2.75; fourth class, \$2.50; class A, \$2.25; class B, \$2; class C, \$1.80; class D, \$1.60. With the

current rates from New York to Chicago, this makes the rate \$4.50 per 100 lbs. from New York to San Francisco, a distance of 3,308 miles by the shortest route and only \$3.00 on fourth class. The rate from Chicago to San Francisco is equivalent to 2.92 cents per ton per mile for first class and 2.08 cents on fourth class; while on class D of car-load freight it is only 1 1/4 cents per ton per mile.

Western & Atlantic.

Hon. Alexander H. Stephens has brought suit against this company to recover a share in the lease from the State which he held as one of the original lessees. This share, he claims, he transferred to the State, but he subsequently discovered that the company held he had abandoned his share, and thereupon transferred it to George H. Hazlehurst. Mr. Stephens now claims that this action was illegal, and the State not having accepted his transfer, he believes that the share now rightfully belongs to him.

Rumford Falls & Bucksfield Branch.

This newly incorporated company purposes building a railroad from Auburn, Me., westerly to Mechanic Falls and thence northward to Rumford Falls on the Androscoggin River. The road will be about 40 miles long, and some 15 miles of it will be parallel to and a few miles from the Portland & Oxford Central.

Transportation in Congress.

In the Senate on the 4th:

The Chair laid before the Senate joint resolutions of the Wisconsin Legislature, asking Congress to provide for the construction of a ship canal around Niagara Falls. Referred to the Committee on Commerce.

Mr. Mitchell, of Oregon, presented a memorial of citizens of Portland, in that State, for Congressional aid in the construction of the Portland & Salt Lake Railroad. Referred to the Committee on Railroads.

Mr. Ramsey, of Minnesota, submitted a resolution instructing the Committee on Transportation Routes to the Seaboard to consider and report upon the expediency of improving water routes and railway communications from the Mississippi Valley to the seaboard, and to regulate commerce among the States by cheapening transportation between the East and West, by improving the navigation of the Mississippi River from its source to the Gulf of Mexico and lake navigation from Lake Superior to Lake Ontario, and by chartering a double-track freight railroad from the Mississippi River to the ocean at the low maximum rate of six mills a ton per mile. The resolution was laid over.

In the House on the 4th, the consideration of the bill to regulate commerce in the several States being resumed:

Mr. Arthur, of Kentucky, of the Committee on Railroads and Canals, concluded the argument begun by him the day before against the constitutionality of the measure. In conclusion he announced his opposition to the bill because it would form an unconstitutional and adulterous intercourse as a political monopoly with chartered monopoly, and because it would form an unconstitutional and pernicious interference with commercial freedom and vested rights. But he especially opposed it because it was centralization, and centralization was the sepulchre of liberty.

Mr. Hurlbut, of Illinois, another member of the Committee on Railroads and Canals, addressed the House in support of the bill, and characterized the argument made by Mr. Arthur against it as an exhibition of the wretched old heresy of extravagant State sovereignty. He declared his belief that whenever there was any commerce which could be properly denominated inter-State commerce, the controlling hand of the United States Government could be laid on it; that every State and every State institution was subordinate to that control, and that every charter for a railroad, for a ferry, or for anything else that was a part of the great system of inter-State commerce, was subject in all respects to the control of Congress.

In the Senate on the 6th:

Mr. Mitchell, of Oregon, introduced a bill providing for the permanent location of the southern terminus of the Oregon Central Railroad, and to amend further the act of May 4, 1870, granting aid toward the construction of the Oregon Central Railroad. Referred to the Committee on Public Lands. The bill provides that the southern terminus of said railroad shall be located at some suitable point on the line of the Oregon & California Railroad, not further south than Eugene City, nor further north than Junction City, and grants the same rights and privileges to aid in its construction to such point as are granted by the original act in aid of the construction of the Oregon Central Railroad and telegraph line from Portland to Astoria and McMinnville. It further provides that in case the quantity of land of 10 full sections per mile cannot be found within the limit prescribed by the original act, selections to make up such deficiency may be made, under the direction of the Secretary of the Interior, on the westerly side of such road, and between it and the Pacific Ocean.

Mr. Ramsey, of Minnesota, called up the resolution introduced by him on the 4th, in regard to cheap transportation and addressed the Senate in favor thereof. He said the annual products of Minnesota were over 22,000,000 bushels of wheat, upon which the average freight to New York was about 57 cents per bushel in winter, and 40 cents per bushel in summer. If grain could be moved at half these rates, it would add nearly \$8,000,000 to the annual income of his State. The same might be said in regard to all the States of the Mississippi Valley. There were three practical ways of doing this: First, by improving the navigation of the Mississippi River, from the Falls of St. Anthony to the Gulf of Mexico, which could be easily and cheaply done—first, by damming up the waters in the lakes of Upper Minnesota, storing it for the dry season, and so obtaining a uniform depth of five feet for the Upper Mississippi; second, by continuing the other improvements now under way; third, by deepening the channel between New Orleans and Gulf. These would give cheap freight by barges to New Orleans and by steamers to Europe. Second, by deepening the channels between the lakes; and but a small appropriation from the United States would be required for this purpose, as Canada would do the rest, and then, under a reciprocity treaty, our ships could be loaded at Duluth for Liverpool, and so have two competing water ways. Third: All Western States are not so favorably situated as Minnesota with two water routes to Europe. The Western States want and must have an all-rail route for freight. The constitutional right to charter and aid such a work is undoubted. Each State surrendered to Congress the right to regulate inter-State commerce, and thus Congress obtained the right absolutely necessary to the prosperity of every Western State to regulate inter-State commerce in as complete a manner as a State can regulate commerce within its own limits.

Our present system of railroads was adapted for the day of small things, when wheat was imported into Minnesota. The mere inspection of the map shows the Western roads radiating from two or three great centers, and the hundreds of Western roads now open have only the same four trunk lines that were in operation twenty years ago, when they had only millions of bushels of grain. We must provide for hundreds of millions of bushels. We need reforms in the present roads and a double-track freight railroad chartered and controlled by Congress, with maximum rates of six mills a ton per mile. This was practicable, and with such a road competing with water-ways by the river, and by the lakes, would give the West at alone

should supply access to the markets of the world for the products of her fields, now rotting in her granaries or burning for fuel.

In the House, on the 6th:

A night session was held, at which speeches were made in favor of Mr. Gray's bill to regulate inter-State transportation, by Wilson, of Iowa, and McNulta, of Illinois, in favor, and Storm, of Pennsylvania, against.

In the House, on the 9th:

Mr. Sheats, of Alabama, introduced a bill for the opening and maintenance of water routes of transportation.

Mr. Hurlbut, of Illinois, presented the joint resolutions of the Illinois Legislature for a law against unjust charges and discriminations by railroad companies.

In the Senate, on the 10th:

Mr. Schurz, of Missouri, presented the resolutions of the Missouri Board of Exchange in favor of improving the Mississippi River. Referred to the Committee on Transportation.

Mr. Howe, of Wisconsin, presented resolutions of the Wisconsin Legislature for the improvement of the water communication between the East and the West. Referred to the Committee on Transportation.

In the House, on the 10th:

Mr. Clark, of Missouri, presented a resolution of the Patrons of Husbandry of the State of Missouri, appealing to Congress to secure the improvement of the navigation of the Mississippi River and its tributaries by ample appropriations for that purpose.

Report of the Chicago & Alton Railroad.

The report of the President, Mr. T. B. Blackstone, for the year 1873, shows the following lines worked by the company during the year, being the same as at the end of the previous year:

	Miles.
Chicago to Joliet (leased).....	38
Joliet to East St. Louis (owned).....	242
Dwight to Washington with branch to Lacon (owned).....	79.8
St. Louis, Jacksonville & Chicago (leased).....	180.6
Broadhouse to Louisiana (owned).....	37.6
Louisiana & Missouri River Railroad (leased).....	101.1
Total.....	649.1

Of this 359.4 miles is owned. The average mileage worked in 1872 was 630 miles.

These roads had the following equipment at the close of the year:

Locomotives.....	155	House freight cars.....	1,614
Pullman sleeping cars.....	12	Combination.....	101
Dining cars.....	5	Stock.....	397
Passenger coaches.....	58	Platform.....	764
Baggage cars.....	4	Drovers'.....	23
Baggage and mail.....	9	Total freight-train cars.....	2,949
Express cars.....	4	Tool and wrecking cars.....	6
Total passenger-train cars.....	99	Pay car.....	1
Total service cars.....	7		

The increase since 1872 consists of 11 locomotives, 1 passenger-train car and 22 freight-train cars.

The property was represented in the capital account as follows at the close of the year:

	DEBTOR.
Cost of road and equipment.....	\$15,505,942 88
Machinery and tools.....	190,544 26
Stocks and bonds owned by company.....	727,712 60
Construction of Louisiana Branch, Western Division, and Louisiana & Missouri River Railroad.....	3,959,450 15
Various other dues and supplies and cash on hand.....	565,343 86
Total.....	\$21,919,993 73

	CREDITOR.
Preferred stock.....	\$2,435,400 00
Common stock.....	8,929,900 00
Funded debt.....	8,851,960 00
Sinking fund.....	46,000 00
C. monon stock scrip.....	1,037,973 00
Unissued stock and bonds.....	37,813 39
Louisiana & Missouri River Railroad.....	1,094,769 23
Due M. K. Jesup & Co. for construction in Missouri.....	546,968 25
Sundry balances due.....	650,367 31
Balance December 31.....	284,813 62
Total.....	\$21,919,993 73

The road owned being 359.4 miles long, the capital stock is at the rate of \$31,595 per mile, and the bonded debt (omitting that of the St. Louis, Jacksonville & Chicago, for which road rental is paid) at the rate of \$14,190 per mile.

The results of the year's working is seen in the following expenses and earnings:

	EARNINGS.
From passenger traffic.....	1873. \$1,329,714 83
From freight traffic.....	8,807,461 76 \$3,607,642 90
From express companies.....	98,851 25 94,868 65
From transporting U. S. mails.....	77,811 36 77,171 64
From miscellaneous sources.....	49,930 59 46,227 69
Total.....	\$5,497,540 77 \$5,156,925 73

	OPERATING EXPENSES.

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The cost of settlement of claims for damages by the Lemont collision, together with the value of the company's property destroyed by it, is reported to have amounted to \$110,000, and a decrease of more than 5 per cent. in the net earnings.

The President says:

"Coal is mined at about one-half of all the stations upon the main line between Wilmington and East St. Louis—a distance of 227 miles—and also at many stations upon your branch lines."

"The increase of gross receipts from freight traffic amounts to about 8 per cent. compared with that of 1872."

"Your property has been, in all departments, maintained in first-class condition, and is fully equal to that of the best Western railways. 5,294 tons of steel rails, 1,210 tons of iron rails, 140 tons of track-spikes, 237 tons splice-bars and bolts, and 175,000 cross-ties have been used in repairs of track."

"Three miles and three-fifths of a mile of additional side tracks and 15½ miles of second or double tracks have been constructed during the year."

"The necessary grading for completing a continuous double main track between Chicago and Joliet has been completed."

"Grading is in progress for a second track from Joliet to Wilmington, including the reduction of the heavy grades on that section of the road."

"That work will be completed by the 1st of May, and thereafter trains between Odell and Chicago, when moving north (in the direction of the heaviest traffic) will not ascend any incline exceeding 24 feet to the mile, and in going south none exceeding 36 feet to the mile; at present several grades exceeding 50 feet to the mile are encountered. This important improvement will enable engines to move much larger trains and greatly reduce the cost of operating upon that part of your lines upon which there is the greatest accumulation of traffic."

"The continued substitution of steel in place of iron rails, as the latter become worn out, is deemed no longer an experiment. It is fully demonstrated to be true economy. We have, at the close of the year, 106 miles of single main tracks and 68 miles of double tracks laid with steel rails. Upon the 649.1 miles of railway operated there is an aggregate of 46 miles of double track and in addition 96.6 miles of side tracks. The double track is in three sections upon the main line between Odell and Chicago. It is important that it should be made continuous, so as to complete a double track railway for the entire distance of 82 miles where a very heavy traffic renders it necessary, and it is hoped that in the course of the present year that will be accomplished."

"The number of miles run by locomotives during the year was 2,983,560—an increase of 81,458 miles, or 2.1 per cent. over the number of miles run in 1872."

"The cost per mile run, compared with that in 1872, is as follows:

	Repairs.	Wages.	Fuel	Oil and Waste.	Cleaning etc.	Total.
1872	6.12 cents	6.59 cents	7.34 cents	0.86 cents	1.20 cents	22.11cts.
1873	6.08 "	6.48 "	7.03 "	0.82 "	1.06 "	21.53 "

"Showing a reduction of 5.9 mills per mile."

"The amount of coal consumed was 94,331 tons, or about 300 tons per day. The amount of wood consumed was 12,933 cords, or 41 cords per day. The distance run by engines per ton of coal averages 37.66 miles, and per cord of wood, 40 miles."

"Experience in operating the 'leased lines' during the past year has demonstrated the following results:

"The Joliet & Chicago Company is paid a fixed rental, and no separate account of the earnings of that line has been kept, but the lease is known to be a profitable one to your company. The net earnings from the traffic of the St. Louis, Jacksonville & Chicago line during the year amount to \$399,429.50, from which, after deducting the amount of rent paid (\$240,000), there remains a net gain to your company of \$159,429.50. A similar computation, based upon the traffic and rent paid for the use of the Louisiana & Missouri River road shows a loss of \$51,174.29."

"Without considering causes of a general nature which have, for the past two or three years, operated to reduce the traffic on all lines in Missouri and Kansas, exceptional reasons can be assigned for the result last stated. During the first two months of the year, the steam ferry at Louisiana could not be operated by reason of ice in the Mississippi River, and all communication with your line was absolutely prevented. Traffic was diverted from it to other channels, and several months were required to restore it again. When that had been, to a great degree, accomplished, the financial panic occurred, resulting in a temporary suspension of the business of nearly all the large cattle dealers in Missouri and Kansas. Many thousands of cattle, which would have been shipped over the Louisiana route, were driven back upon the plains to be kept until the next shipping season, and thus the traffic during the last quarter of the year, which consists of, or depends very largely upon, the shipment of cattle, was almost wholly suspended."

"The necessity for the construction of a bridge over the Mississippi River to connect your lines at Louisiana, was shown in our last annual report. To accomplish that object, the Mississippi River Bridge Company was duly organized, and after some delay, occasioned by the opposition of the 'steamboat interest,' the plans submitted by the company were approved by the Secretary of War as required by law, and the company was at liberty to proceed with the work. The approval was, however, upon condition that certain specified 'dykes,' and other structures for the purpose of improving the navigation of the river for a considerable distance above the bridge, should be constructed at the expense of the Bridge Company, the expense of which has largely increased the cost of the work. The construction of the bridge was commenced on the 30th day of June last, and completed so as to admit of its use for the passage of trains on the 24th of December. The entire work having been accomplished in less than six months at a cost, including dykes, approaches, &c., of \$685,000."

"The bridge is 2,042 feet in length. The superstructure is of wrought iron, and rests upon piers and abutments of masonry of the most substantial character."

Train Accidents in February.

Very early on the morning of the 1st, the engine and a milk car of a mail train on the Harlem Extension Railroad were thrown from the track by a misplaced switch in the yard at Rutland, Vt.

On the 2d, at Burnett Junction, Wis., on the Chicago & Northwestern Railway, two sleeping cars of a passenger train were thrown from the track and down a high embankment at a broken rail.

About noon on the 2d the tender and baggage car of a west-bound passenger train on the Knox & Lincoln Railroad were thrown from the track by a broken switch at Nequasset Pond, Me., the car being badly damaged.

On the night of the 2d the engine of a south-bound express train on the Vermont Central road was thrown from the track by a misplaced switch at Essex Junction, Vt., delaying the train some hours.

Early on the morning of the 3d an axle broke under a Pullman coach at Leland, Ill., on a west-bound express train on the Chicago, Burlington & Quincy Railroad.

On the morning of the 3d the tender of a north-bound passenger train on the River Division of the Cleveland & Pittsburgh road was thrown from the track near Bellaire, O.

On the 3d, near Emigrant Gap, on the Central Pacific Railroad, two locomotives were thrown from the track, tearing down 20 feet of a snow-shed, damaging both locomotives and severely injuring one of the engineers.

On the 3d, a car of a local train on the Amboy Division of the Pennsylvania Railroad ran off the track and into a stone wall in Bordentown, N. J., and was badly wrecked.

On the afternoon of the 3d, in Long Island City, on the Long Island Railroad, the locomotive, tender and three cars of a west-bound freight train ran off the track where rails had been removed for repairs, and were badly wrecked, blocking the road some hours. The trackmen had neglected to put out a signal.

On the night of the 3d, a north-bound express train on the Lowell & Nashua Railroad was thrown from the track in a snow storm near Tyngsboro, Mass.

An engine following with a snow plow was signalled and stopped, and was shortly afterwards run into by a second engine which was following.

On the 4th, a freight train on the Northern Railroad of New Jersey ran off the track between New Durham and Homestead, causing some damage and considerable delay.

On the afternoon of the 5th a passenger train on the Erie Railway was thrown from the track at Stockport, N. Y., by a broken rail.

On the evening of the 5th, near Kishwaukee, Ill., on the Wisconsin Division of the Chicago and Northwestern Railway, the baggage car, second-class car, and three coaches of a south-bound passenger train were thrown from the track by a defective rail, and went down a bank about 25 feet high. The cars were burned. Five passengers were slightly injured. The loss is estimated at \$25,000, besides the passengers' baggage.

On the night of the 5th four cars of a freight train on the Cincinnati, Hamilton & Indianapolis road were thrown from the track and wrecked near Julietta, Ind.

Early on the morning of the 6th, near Gridley, Ill., a driving wheel broke under the engine of a west-bound passenger train on the Lehigh, Peoria & Warsaw Railroad, throwing the engine into the ditch.

On the morning of the 6th, eight miles from New Brunswick, N. J., on the New York Division of the Pennsylvania Railroad, as a north-bound express train was running at a high rate of speed the three rear coaches broke off and of course pulled the bell on the engine, at which the engineer put on brakes instantly. This slackened the train so that the cars which had broken off overtook it with a shock that two sleeping cars were badly broken.

On the morning of the 6th the tender and baggage car of a south-bound passenger train on the Burlington, Cedar Rapids & Minnesota road were thrown from the track near Ely, Ia., by a broken rail, the car going into the ditch. A brakeman was severely injured.

About noon on the 6th, near West Warren, Mass., on the Boston & Albany Railroad, an east-bound passenger train was thrown from the track by a broken rail, every car going off and several getting badly broken.

On the evening of the 6th, near Palmer, Mass., on the Boston & Albany Railroad, there was a butting collision between a wrecking train, which had been clearing the track from the passenger train wreck at West Warren, and a local freight, by which one engine was thrown from the track and badly damaged.

On the evening of the 6th, an axle broke under the locomotive of a train on the New York Elevated Railroad, which was followed by the bursting of a flue by which the fireman was badly scalded. The accident occurring between stations, the passengers had to be removed by ladders. The track was badly damaged for about 20 feet, so that the road was made impassable for nearly 24 hours. Probably the unevenness of the road occasioned the fracture of the axle.

On the evening of the 6th, near Rensselaer Falls, N. Y., on the Rondout, Watertown & Ogdensburg Railroad, there was a butting collision between a north-bound passenger train and an engine with two cars bound south. The two cars had been broken from a south-bound train which had two engines, and on their loss being discovered at Rensselaer Falls one of the engines backed after them, it being understood that the north-bound passenger would be held until it had returned, which was not done. Both engines and one car were wrecked, a conductor and a passenger injured, while the road was blocked 16 hours.

On the 7th, as an east-bound freight train on the Detroit, Eel River & Illinois road was passing Taylor's Switch, Ind., a wheel on a car in the middle of the train jumped to the outside of the rail and ran in that way five miles, to the crossing of the Pittsburgh, Fort Wayne & Chicago, cutting the bolts and spikes from the rail. No other wheel left the track, but the whole five miles of rail had to be re-spiked.

On the afternoon of the 7th, a mile south of Fort Ann, N. Y., on the Rensselaer & Saratoga Railroad, the rear coach of a south-bound passenger train was thrown into the ditch by a broken rail, caught fire, and was burned. One passenger was killed and three injured out of five in the car.

On the morning of the 9th near Lick Creek, Tenn., on the East Tennessee, Virginia & Georgia road six cars of a west-bound freight train were thrown from the track and badly wrecked.

On the 10th an engine on the Western Division of the Vermont Central road ran into some lumber cars standing on a side track at Alburgh, Vt., and was badly damaged.

On the 10th a freight train on the Indianapolis, Bloomington & Western road was thrown from the track and wrecked, delaying all trains eight hours.

On the 10th, about one o'clock in the morning, fifteen cars of an extra freight train were thrown from the track by a broken rail on the Chicago & Iowa Railroad between Chana and Flag Centre, Ill., blocking the road four or five hours.

On the afternoon of the 10th, in Jersey City, on the Central Railroad of New Jersey, a freight locomotive ran into a caboose car which was standing near the round-house, and did damage to the amount of \$1,800.

On the evening of the 10th an east-bound express train on the Chicago, Rock Island & Pacific Railroad was thrown from the track near Grinnell, Ia., and delayed four hours.

Early on the morning of the 11th a south-bound train on the Keokuk and Des Moines Railroad was thrown from the track while crossing a bridge near Eldon, Ia., and five cars loaded with hogs were wrecked, killing 30 hogs and damaging the bridge. The accident is variously explained by a broken rail and a broken truck.

On the morning of the 11th, on the Madison Division of the Chicago & Northwestern Railway, near Afton, Wis., 12 cars of an east-bound freight train were thrown from the track and into the ditch by a broken rail.

On the morning of the 11th an iron bridge near Menominee, Ill., on the Illinois Central Railroad fell as a freight train was passing over it, carrying with it four freight and the caboose car. The conductor was injured.

On the evening of the 11th, on the Atlantic & Great Western Railroad, near Leavittsburg, O., an axle broke under a car of a local freight train. The bridge, which was a new wooden one, was wrecked and eight cars went down into the water.

On the afternoon of the 12th a switching engine of the Cincinnati, Hamilton & Indianapolis road jumped the track in Indianapolis and was badly damaged.

On the night of the 12th a wheel came off the engine of a west-bound express train on the La Crosse Division of the Milwaukee & St. Paul, delaying the train five hours.

On the morning of the 13th the engine of a freight train on the Philadelphia & Reading Railroad, while switching some cars at Mt. Carbon Junction, Pa., ran into the rear of an empty coal train which was moving on to a side track, wrecking a number of coal cars and damaging the freight engine. Neglect on the part of a signalman is said to have caused the accident.

On the 13th, near Summit, Cal., on the Central Pacific Railroad, as a snow-plow with six engines was clearing the track after a heavy storm, the plow jumped the track in a snow-shed, damaging the shed and plow somewhat.

A few minutes afterward an east-bound passenger train which was following the snow-plow ran into the rear of the snow train, damaging badly its own engine and two of those attached to the plow.

On the night of the 13th an extra freight train on the Madison Division of the Chicago & Northwestern ran off the trestle bridge near Black River, Wis., wrecking both the train and the bridge and blocking the road over 12 hours.

Early on the morning of the 15th, three flat cars jumped the track at the crossing of the Indianapolis, Bloomington & Western and Indianapolis & St. Louis roads in Indianapolis, upsetting the switch-house and injuring two men who were inside.

On the morning of the 15th, at Summit, Cal., on the Central Pacific Railroad, an east-bound passenger train got off the track and was delayed four hours. There was much snow on the track.

On the 15th, at New England Mills, Cal., on the Central Pacific Railroad, a freight train ran off the track and blocked the road three hours. There had been a heavy snow storm the day before.

On the morning of the 16th, between 1 and 2 o'clock, a heavy freight train going at a rapid rate ran into a land-slide on the Lehigh & Susquehanna Railroad near State Dam station, Pa. This land-slide completely blocked the road and caused the engine to jump clear from the track so that it hung over the river bank. Eighteen cars were piled up, and nine of them burned, catching fire from the stove in the caboose. The engineer and three other trainmen were killed, and the fireman and a brakeman were badly hurt.

On the 16th, an east-bound passenger train on the Iowa Division of the Illinois Central Railroad ran over a broken rail near Fort Dodge, Ia., and a baggage car, two passenger and a sleeping car went into the ditch.

On the 16th, three cars of an extra train on the Housatonic Railroad ran off the track near Cornwall Bridge, Conn., one of the cars going down a bank 20 feet high and into the river bottom up. Spreading of the rails is said to have caused the accident.

On the 16th, the engine of an express train on the Indianapolis, Bloomington and Western Railway was disabled by the blowing out of a cylinder head, when the train was 30 miles west of Indianapolis.

On the evening of the 16th, on the Canandaigua, Batavia & Tonawanda Branch of the New York Central & Hudson River Railroad, between Le Roy and Caledonia, N. Y., eleven freight cars, a baggage car and a passenger car were thrown from the track and wrecked, blocking the road some hours.

On the night of the 16th, a west-bound train on the Galena Division of the Chicago & Northwestern Railway was thrown from the track at Huntley, Ill., by a misplaced switch, causing some hours' delay.

Early on the morning of the 17th, as a north-bound coal train on the Chicago & Alton Railroad was approaching the bridge over the Kankakee River, the locomotive and three cars ran off the track and upon the bridge, damaging one span of it badly.

On the evening of the 17th, the draw-bar between the engine and tender of a train on the Amboy Division of the Pennsylvania Railroad broke when the train was near South Amboy, N. J., and the fireman, who was on the tender, was thrown on the track, the whole train passing over him and killing him instantly.

On the morning of the 18th, near Canton, Miss., on the New Orleans, Jackson & Great Northern Railroad, there was a collision between an incoming and an outgoing passenger train, caused by a misplaced switch. Both locomotives were badly damaged.

On the 18th, between Bloomfield and Moulton, Iowa, on the St. Louis, Kansas City & Northern Railway, a freight train broke through a bridge, wrecking ten cars and blocking the road six hours.

On the afternoon of the 18th, near East Clarendon, Vt., on the Rutland Division of the Vermont Central Railroad, a parallel rod broke on the locomotive of a north-bound mail train, damaging the engine badly.

On the morning of the 19th, an engine and baggage car of a south-bound passenger train jumped the track near Muldraugh's Hill, Ky., on the Louisville & Nashville Railroad, delaying the train several hours.

On the 20th, four freight cars of a mixed train on the Winona & St. Peter road were thrown from the track on a bridge near Minnesota City, Minn., damaging the bridge somewhat.

On the 20th, there was a collision between two gravel trains on the New York, New Haven & Hartford Railroad in New Haven, Conn., by which two cars were broken up and a brakeman badly injured.

On the 21st, on the Burlington, Cedar Rapids & Minnesota road, near Cedar Valley, Ia., the sleeping car of a south-bound express train was thrown from the track and into the ditch by a broken rail, over which the rest of the train had passed in safety.

On the 21st, on the Madison Division of the Chicago & Northwestern Railway, 18 empty cars of a freight train were ditched at a curve near Dover, Wis. The report says that the train was a very long one, drawn by two engines, and the cars, which were in the middle of the train, were fairly jerked from the track.

On the evening of the 21st, as a Grand Trunk passenger train was crossing the bridge of a street in Black Rock, near Buffalo, the rear car ran off the track and broke through the floor of the bridge, lifting the car body from the trucks and damaging the bridge badly. One passenger was injured.

On the 22d, on the Jefferson Branch Railroad, near Uniondale, Pa., as a pushing engine belonging to the Delaware & Hudson Canal Company was running backwards down grade it jumped the track on a high trestle and fell to the ground 70 feet below. The engineer, fireman, conductor, brakeman and another man were on the engine and were all killed.

Early on the morning of the 23d a freight train on the Madison Division of the Chicago & Northwestern Railway, ran into the rear of a wood train at Sparta, Wis., damaging the freight engine and wrecking several wood cars.

On the morning of the 23d a freight train on the Winona &

St. Peter Railroad was thrown from the track near Janesville, Minn., killing one train hand and injuring three others. There was much snow on the track at the time.

On the morning of the 23d a passenger coach of a train on the Parker & Karns City Railroad jumped the track just after leaving a high trestle.

On the morning of the 23d, at Miller, Ind., on the Lake Shore & Michigan Southern Railway, the locomotive of a freight train ran off the track and blocked the road about an hour.

On the 23d a freight train on the South and North Alabama road, at Birmingham, Ala., ran off the track, delaying trains some four hours.

On the afternoon of the 23d the locomotive of a train on the Parker & Karns City road jumped the track.

Late on the evening of the 23d the locomotive of a train on the Parker & Karns City Railroad jumped the track near Argyle, Pa., delaying the train some hours. The road is new and not yet ballasted.

On the night of the 23d two freight trains on the Indianapolis, Bloomington & Western Railway were thrown from the track.

On the morning of the 24th an axle broke under the tender of a mixed train on the Montclair Railroad, near Pompton Junction, N. J., throwing the engine, tender and passenger car from the track.

On the morning of the 24th, an east-bound stock train on the Canada Southern Railway ran off the track on the Drew's Pond bridge. Two cars of cattle went into the pond and the bridge was badly damaged.

On the 24th, near Alden, Ia., on the Iowa Division of the Illinois Central, one car and the caboose of a freight train were thrown from the track in a snow storm.

On the 24th, near Alden, Ia., on the Iowa Division of the Illinois Central, nine cars of a freight train were thrown from the track, which was obstructed by snow.

On the 24th, a parallel rod broke on a passenger engine on the Cleveland, Columbus, Cincinnati & Indianapolis Railway, wrecking the cab on the fireman's side.

On the afternoon of the 24th some cars of a freight train on the Erie Railway jumped the track near Paterson, N. J., causing some delay to trains.

On the morning of the 25th, at Dick's Switches in Elizabeth, N. J., on the Central Railroad of New Jersey, there was a collision by which a locomotive and two freight cars were wrecked.

On the 25th, at Coatsburg, Ill., on the Chicago, Burlington & Quincy Railroad, a center-pin dropped down under a car in a freight train and caught on the ties, throwing off two cars and ditching one, and blocking the road an hour and a half.

On the 25th, on the European & North American Railway, at Bangor, Me., a train ran off the track, badly damaging several cars.

On the morning of the 26th, at Dick's Switches in Elizabeth, N. J., on the Central Railroad of New Jersey, a coal train ran off the track and seven cars were wrecked, blocking the road for a time.

About noon on the 27th, a train on the Chicago & Northwestern Railway ran off the track on a trestlework about two miles east of Winona, Minn., on the Wisconsin side of the river. The baggage car and two coaches went off the trestle and fell to the ground, turning completely over, killing one passenger and injuring five others.

On the morning of the 28th, as the Buffalo express on the Lake Shore & Michigan Southern Railway was backing from a switch on to the main line in Detroit, Mich., the rear coach jumped the track and went into the ditch.

On the 28th, on the Central Railroad of New Jersey, near Bloomsbury, five cars of a freight train were thrown from the track by a loose rail and badly wrecked.

On the night of the 28th, on the Great Western Railway, seven miles west of London, Ont., the passenger coach of a west-bound accommodation train took fire from the falling of a lamp in the saloon at the forward end of the car. The bell-rope was not attached to the engine, and the train ran two miles before the engineman could be signaled to stop. The car was entirely destroyed, and eight passengers were suffocated or burnt to death. Thirteen passengers were injured by jumping from the car while running.

Very early in the month, as an up freight train on the Alabama & Chattanooga Railroad was crossing Gulf Creek Bridge, near Ashville, Ala., the drawhead of the second car pulled out and struck the timbers of the bridge, and seven cars went through the bridge into the creek.

In the early in the month, near Jackson, Tenn., on the Mobile & Ohio Railroad, as an engine was hauling a freight train up a heavy grade, moving very slowly, the boiler exploded, killing the fireman and severely injuring the engineman and conductor who was on the engine.

About the middle of the month eight cars of a freight train on the St. Louis, Kansas City & Northern Railway ran off the track and were wrecked, killing a passenger.

In the latter part of the month, near Stoutsburg, Mo., on the Hannibal Division of the Missouri, Kansas & Texas Railway, several cars of a freight train ran off the track, blocking the road some hours.

About the same time, and on the same road, a night passenger train ran into some freight cars which had been blown from a siding to a main track near Hannibal, disabling the locomotive.

This is a total of 89 train accidents, by which 24 persons were killed and 44 injured.

These accidents may be classified according to their nature and causes as follows:

COLLISIONS:
Rear collisions..... 7
Butting collisions..... 4
Unexplained..... 3
— 14

DERAILEMENTS:
Unexplained..... 32
Broken rail..... 10
Snow on track..... 7
Broken axle..... 3
Misplaced switch..... 3
Defective rail..... 1
Loose rail..... 1
Spreading of rails..... 1
Rail removed..... 1
Broken switch..... 1
Broken truck..... 1
Drawhead pulled out..... 1
Center pin dropped out..... 1
Land-slide..... 1
Starting up suddenly on curve..... 1

Broke bridge..... 2
Broken parallel rod..... 2
Broken drawbar..... 1
Broken axle..... 1
Boiler explosion..... 1
Blowing out cylinder head..... 1
Wheel off..... 1
Car burned while running..... 1

Total..... 90

One collision was caused by a misplaced switch and one by the breaking in two of a train. Thirty accidents were caused by defects or breakages of road or rolling stock, and four by neglect or mistake of signals.

Ten accidents caused the death of one or more persons; eight others caused injuries, leaving 72 by which no person was injured.

The number of accidents is very much less than for February of last year, when 133 accidents were recorded, causing the death of 25 and injury to 126 persons. This, doubtless, results from the comparative mildness of the present winter, the number of broken rails and accidents caused directly by snow being much less.

For the twelve months ending with February the record is as follows:

	No. of Accidents.	Killed.	Injured.
March	112	18	92
April	101	23	83
May	79	10	113
June	90	12	104
July	90	18	80
August	150	63	155
September	106	29	75
October	88	11	47
November	76	11	50
December	80	16	43
January	108	18	98
February	90	25	49
Totals.....	1,170	263	989

The average per day for the year is 3.2 accidents, 0.69 killed and 2.71 injured; for the month of February, 3.21 accidents, 0.93 killed and 1.75 injured. The proportion of killed to injured is unusually high for the month.

[Entered according to Act of Congress, in the year 1874, by the RAILROAD GAZETTE, in the office of the Librarian of Congress, at Washington.]

THE CATECHISM OF THE LOCOMOTIVE.

By M. N. FORNEY, Mechanical Engineer.

PART VII.—(CONTINUED.)

THE LOCOMOTIVE BOILER.

QUESTION 95. How can the strain on the cylindrical part of a boiler be calculated?

Answer. By multiplying the diameter in inches by the length in inches and the product by the steam-pressure per square inch. Thus for a boiler 48 inches in diameter and 10 feet long with 100 pounds pressure the calculation would be

$$\begin{array}{r} 48 \\ \times 120 \\ \hline 5760 \\ \times 100 \\ \hline 576,000 \text{ lbs.} \end{array}$$

The sides of the boiler must therefore have a strength sufficient to resist this force which tends to tear them asunder. If the boiler is made of iron $\frac{3}{8}$ inch thick there would be a sectional area of 45 square inches on each side, or a total of 90 square inches to resist this strain, so that each square inch must bear 6,400 lbs. of strain. The correctness of this rule can be demonstrated by the use of mathematics, which would be out of place here. Its practical truth has also been proved by experiment.

QUESTION 96. How much strain per square inch is good boiler plate capable of resisting, and how much is it safe to subject it to?

Answer. There is great variation in the tensile strength* of rolled iron boiler plate, but that of good plate will average about 50,000 pounds per square inch, if the strain is applied in the direction of the "grain" or the fibres of the iron and about 10 per cent. less of the strain is applied crosswise of the grain. It has, however, been found by experiment that when a tensile strain is applied to a bar of iron or other material, it is stretched a certain amount in proportion to the length of the bar and to the degree of strain to which it is subjected. It is found that if this strain does not exceed about one-fifth of that which would break the bar, it will recover its original length, or will contract after being stretched, when the strain is removed. The greatest strain which any material will bear without being permanently stretched is called its *limit of elasticity*, and so long as this is not exceeded no appreciable permanent elongation or "set" will be given to iron by any number of applications of such strains or loads. If, however, the limit of elasticity is exceeded, the metal will be permanently elongated, and this elongation will be increased by repeated applications of the strain until finally the bar will break. At the same time the character of the metal will be altered by the repeated application of strains greater than its elastic limit, and it will become brittle and less able to resist a sudden strain, and will ultimately break short off. It is therefore unsafe to subject iron, or in fact any other material, to strains greater than its elastic limit. This limit for iron boiler plates may be taken at about one-fifth its breaking, or, as it is called, *ultimate strength*. It should be remembered, however, in this connection, that it often happens that the steam pressure is not the greatest force the boiler must withstand, as sudden or unequal expansion and contraction are probably more destructive, to locomotive boilers especially, than the pressure of the steam.

QUESTION 97. How are the plates of boilers fastened together?

Answer. With rivets, which are made with a head at one end, and are inserted while they are red-hot into holes drilled or punched in the edges of the plates. After they are in the holes, a head is formed on the other end, either with blows from hand hammers, or by a machine constructed for the purpose. In these machines the rivet after it is in the holes is brought between a fixed and a movable die, the head which is made with the rivet being placed against the fixed die, and the movable die is then pressed, either by steam or hydraulic pressure with great force against the other end of the rivet,

* A force exerted to pull any material apart is called a *tensile strain*, and if exerted to compress it is called a *compressive strain*.

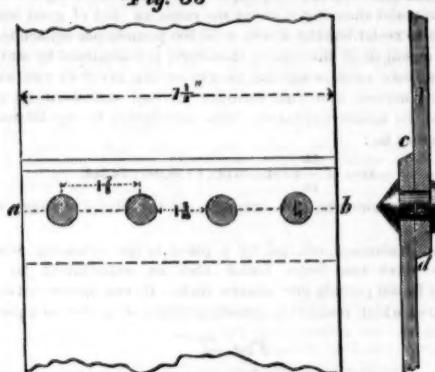
† It should be explained that in the process of manufacturing iron by rolling, the iron is stretched out into fibres in the direction in which it passes between the rolls.

thus forcing the end of the rivet into the form of the die, which is made of the proper shape and size for the rivet head. The powerful pressure which is thus brought on the rivet causes it to be pressed into all parts of the two holes, thus completely filling them both; whereas with hand riveting, the holes are not nearly so completely filled, as it is impossible with blows of a hammer to subject the rivets to so powerful or uniform a pressure as the machine brings upon them.

QUESTION 98. What is the strength of riveted seams compared with that of the solid plate?

Answer. The strength of a riveted seam depends very much upon the arrangement and proportion of the rivets, but with the best design and construction, the seams are always weaker than the solid plates, as it is always necessary to cut away a part of the plate for the rivet holes, which weakens the plate in three ways: 1. By lessening the amount of material to resist the strains. 2. By weakening that left between the holes. 3. By disturbing the uniformity of the distribution of the strains. The first cause of weakness is obvious from an inspection of an ordinary seam, riveted with a single row of rivets, fig. 53. In this we have two plates $7\frac{1}{2}$ inches wide and

Fig. 53



$\frac{1}{8}$ thick fastened with four rivets 11-16 inches in diameter and $1\frac{1}{4}$ inches from centre to centre. The section of the plate calculated with decimals would therefore be $.375 \times 7.5 = 2.81$ square inches. A piece 11-16 inch wide and $\frac{1}{8}$ inch thick would be removed to form each hole, or a sectional area for the whole plate of $.375 \times .0875 \times 4 = 1.03$ square inches, so that the section of the plate would be reduced through the holes $2.81 - 1.03 = 1.78$ square inches. In other words, on

Fig. 54

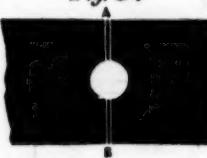


Fig. 55



the dotted line a, b , it will have only about 63 per cent. of the sectional area of the solid plate.

The second cause of the reduction of strength is owing to the injury sustained by the plates during the process of drilling and punching. The knowledge existing regarding this subject is not very accurate, although numerous experiments have been made to determine the exact amount of weakening caused by punching plates. It is, however, certain that in many cases the strength of the metal left between the holes of boiler plates is reduced from 10 to 30 per cent. by the process of punching. It is probable, however, that soft ductile metal is injured less than that which is harder and more brittle. Some kinds of steel plates are especially liable to injury from punching. It is also probable that the condition of the punch, and the proportions of the die used with it, have much to do with its effect upon the metal.

The third cause of weakness is owing to the fact that if one or more holes are made in a plate of any material, and it is then subjected to a tensile strain, the strain, instead of being equally distributed through the section left between the holes, will be greatest in that part of the metal nearest them. This can be illustrated by taking a band of india-rubber, fig. 54, and cutting a round hole in it to represent a rivet hole. If we draw two parallel lines, A, B , across the band and then stretch it, the lines, instead of remaining parallel when the band is stretched, will separate most next to the hole, as shown in fig. 55, indicating that the fibres of the rubber nearest the hole are strained most. A similar effect takes place when a plate of iron is stretched, so that a fracture is liable to begin next to the hole, after which the plate will be broken as it were in detail.

Fig. 56



QUESTION 99. How may a boiler seam like that shown in fig. 53

break?

Answer. It may break in three different ways:

† In the following calculations all the dimensions have for convenience been reduced to decimals.